Elektroniikka

Kilpailuosio X, piirikortin kokoaminen ja testaus

Johdanto

Aiemmassa osiossa suunniteltu piirikortti kootaan ja testataan. Kortti tullaan lopullisesti kiinnittämään Nokian robottiin paineilmasormen paikalle lasermodulin kanssa.

Tehtävän kuvaus

1. Alkutoimet

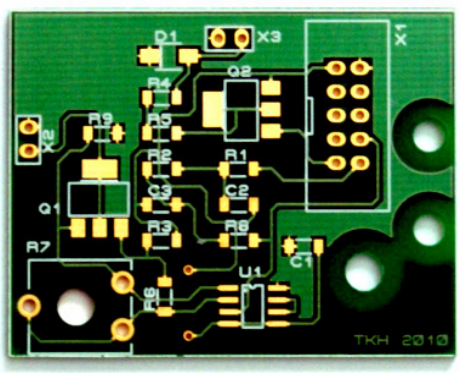
Varmista, että sinulla on tätätehtävää varten annettu osapussi ja piirikortin suunnittelutehtävässä käytetty osaluettelo ja kytkentäkaavio. Osapussissa pitäisi olla osaluettelon mukaiset komponentit, ja niiden sijoittelutietojen pitäisi olla näkyvillä piirilevyn merkinnöissä. Ilmoita tuomarille puutteesta jo ennen tehtävän aloitusta. Tarkasta, että saamasi komponentit ovat tallella ja niiden laatu ja lukumäärä vastaavat piirikaaviota.

Ilmoita avustavalle tuomarille poikkeamista tai puutteista. Jos tarvitset apua nosta käsi ylös merkiksi avun tarpeesta, odota paikallasi kunnes avustava tuomari tulee luoksesi.

Lue tehtäväkuvaus huolella ja tutustu muuhun oheismateriaaliin ennen kuin aloitat. Huomioi myös tehtävässä arvosteltavat kohteet!

2. Piirikortin kokoaminen

Kokoa tehtävän piirikortti. Tekemäsi työn jälki ja käyttämäsi työskentelytavat arvioidaan kaikkineen. Ole huolellinen juotoksissa, ylimääräiset tinaroiskeet, korjatut tinasillat ja muu työn jälki arvostellaan. Komponenttien asennustyön voi tehdä vain yhdellä tavalla – hyvin, kiinnitä huomiota pieniinkin yksityiskohtiin. **Kun saat piirikortin valmiiksi, niin ilmoita siitä tuomarille**. Hän tuo sinulle tehtävän jatkamiseen liittyvät dokumentit.



Kuva koottavasta piirikortista.

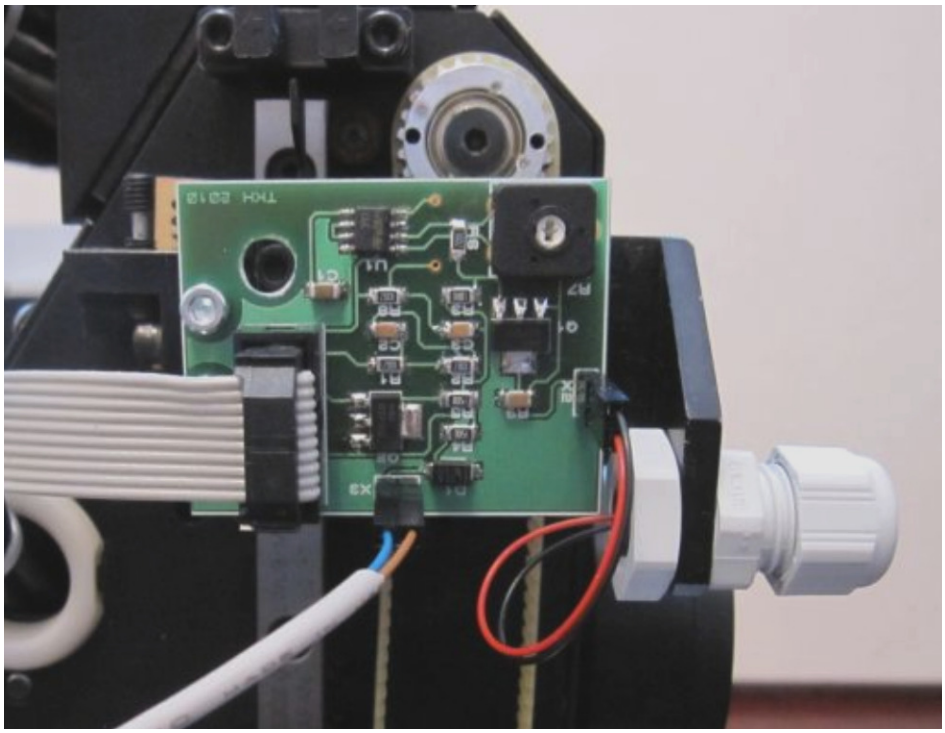
Arviointikohteet

Arviointi-kohteen tyyppi O = Obj S = Sub	Arviointikohde - Nimi tai lyhyt kuvaus	Vain objektiiviselle arvioinnille		Pisteet
		Tavoitearvo	Lisätietoa - (Lisää uuden rivin arviointikohteen alle)	
O	Laitteen toiminta	IPC-A-610 D	Toimii 100% Toimii 50% (vain 5 p)	**7,00**
O	Komponenttien kiinnittäminen	IPC-A-610 D	Juotosten laatu	**5,00**
O	Komponenttien asettelu	IPC-A-610 D	Asettelun laatu	**4,00**
O	Mittaus ja säätö	Oikeat arvot	Kortti säädetty oikein, mittaukset oikein	**4,00**

3. Piirikortin korjaaminen, asentaminen ja testaus (annetaan piirikortin kokoamisen jälkeen)

Piirikortin valmistuttua huomattiin, että kaiutinlähdön rajoitusvastukset tulivat liian suuriksi. Tästä johtuen vastukset R4 ja R5 pitää vaihtaa. Poista kyseiset komponentit ja juota tilalle tuomarilta saamasi uudet vastukset. Uusien vastusten tulisi olla 27 Ω:n suuruisia.

Vastukset vaihdettuasi varmista vielä, että kaikki komponentit ovat oikein päin, ja että komponenttien jalkojen välissä ei ole tinasiltoja. Kiinnitä piirikortti tämän jälkeen robottiin allaolevan kuvan mukaisesti. Muista, että piirikortin ja robotin rungon välissä käytetään muovista korotuspalaa (ei näy kuvassa).



Kiinnitä myös lasermoduli (kuvassa oikeassa alaneljänneksessä) kuvan osoittamalla tavalla.

3. Piirikortin testaaminen

Kun saat piirikortin kiinnitettyä robottiin, niin suorita allamainitut mittaukset ja kirjaa seuraavalle sivulle sekä mittaustuloksesi että käyttämäsi mittausmenetelmä. Muista kirjata myös nimesi, kilpailijanumerosi ja käyttämiesi mittalaitteisen tyypit.

Huom! Älä katso lasersädettä suoraan. Se voi vahingoittaa silmiäsi.

1. Mittaa liittimen X1 nastasta 10 tulevan signaalin (LASER_REF) taajuus ja pulssisuhde. (1p.)

2. Säädä vastuksen R7 avulla vastuksen R3 läpi kulkeva virta arvoon 11 mA ±10%, ja määritä säädetystä piiristä trimmeripotentiometri R7:n resistanssi. (2p.)

3. Mittaa transistorin Q2 läpi kulkevan virran arvo transistorin johtaessa. (1p.)

Kun saat mittaukset tehtyä, niin ilmoita siitä tuomarille. Hän kerää mittaustuloksesti pois ja tehtävä on päättynyt sinun osaltasi. Älä koske enää tehtävän jälkeen robotin tai laserkoritn säätöihin. Piirikortin täytyy olla lopettaessasi myös täysin asennettuna (kaikki johdot paikallaan ja kortti kiinnitettynä).

Mittauspöytäkirja

Nimi: _____

Kilpailijanumero _____

Mittauksissa käytetyt mittalaitteet:

_____

_____

_____

_____

Kohta 1

Mittaustulos _____

Menetelmä _____

Kohta 2

Mittaustulos _____

Menetelmä _____

Kohta 3

Mittaustulos _____

Menetelmä _____

```
/*****************************************************************
*                                                                *
*  Base firmware for Task robot (year 2010 version)              *
*  (SAMPLE CODE)                                                 *
*                                                                *
*  MCU:      ATmega324p                                          *
*  Clock:    16MHz XTAL                                          *
*  Compiler: WinAVR (avr-gcc) version 20071221                   *
*                                                                *
*  - Toni Harju 2010                                             *
*                                                                *
*****************************************************************/

#define F_CPU   16000000               // clock frequency for delay.h
#include <avr/io.h>
#include <avr/interrupt.h>
#include <util/delay.h>

#define XTAL    16000000        // Clock frequency for calculating USART
baudrate
#define BAUD    38400           // USART BAUDRATE, 9600bps
#include "USART1.c"
#include "LaserCard.c"

#define strobe 0
#define DIR_Y 1                 // Y axis, direction
#define CLK_Y 2                 // Y axis, clock
#define Y_END_R 2               // Boundary switch, "right" end
#define Y_END_L 3               // Boundary switch, "left" end
#define DIS 3

#define DIR_Z 5                 // Z axis, direction
#define CLK_Z 6                 // Z axis, clock
#define Z_END_F 1               // Boundary switch, "front"
#define Z_END_B 0               // Boundary switch, "back"

// movement directions (used in main() and Move())
#define MV_UP                   1
#define MV_DOWN                 2
#define MV_LEFT                 3
#define MV_RIGHT                4


// function prototypes
void Move(unsigned char dir, unsigned char steps);
char StrCompare(const char *ref, unsigned char *data);

// global variables

// main program begins here...
//
// - TKH 2010
int main(void)
{
        ACSR |= 1<<ACD;                 // disable the comparator
        DDRA = 0xFF;                            // PORTA, all outputs
        PORTA=0b01001101;

        // portB directions
        DDRB =  0b11000000;

        // portB initial state
        PORTB = 0b10000000;

        // Initialize the LaserCard
        _Init_LaserCard();

        // initialize the USART
```

```
        _USART1_Init();
        // global enable interrupts
        sei();

        Move(MV_DOWN,0);
        Move(MV_RIGHT,0);
        _pwm_set(_pwm_test_data[4]);

        while(1)
        {
                _sound_ena=1;
                _delay_ms(500);
                _sound_ena=0;
                _delay_ms(500);
        }
}

// The Timer0 interrupt is defined in "LaserCard.c"
TIMER0_INTERRUPT



// USART interrupt routine
//
// - TKH 2010
ISR(USART1_RX_vect)
{
        unsigned char c;

        c=UDR1;
}




// This function moves the robot finger
// dir, direction [1,2,3,4]
// steps, number of steps, drives to the edge if 0 or 255
//
//
void Move(unsigned char dir, unsigned char steps)
{
        unsigned char rest=0xFF, active=PORTA, dir_mask=0;

        if(dir==MV_UP)
        {
                rest &= ~0b01000000;
                active |=  0b00100000;
                dir_mask=0b00000001;
        }
        else if(dir==MV_DOWN)
        {
                rest &= ~0b01000000;
                active &= ~0b00100000;
                dir_mask=0b00000010;
        }
        else if(dir==MV_LEFT)
        {
                rest &= ~0b00000100;
                active &= ~0b00000010;
                dir_mask=0b00001000;
        }
        else if(dir==MV_RIGHT)
        {
                rest &= ~0b00000100;
                active |=  0b00000010;
                dir_mask=0b00000100;
        }
```

```
        PORTA=active;
        _delay_us(100);

        if(PINB & dir_mask)      return;

        do
        {
                PORTA&=rest;
                _delay_us(300);
                PORTA|=0b01000100;
                _delay_us(1800);        // 1800 = max isolle moottorille, 950
menee vielä pienelle moottorille...
                if(steps < 255) steps--;
        }
        while(steps && !(PINB & dir_mask) );
}



// this function checks wether the given string ref can be found
// at given position on string data
//
// - TKH 2008
char StrCompare(const char *ref, unsigned char *data)
{
        do
        {
                if(*ref != *data) return 0;
                ref++;
                data++;
        }
        while(*ref);

        return 1;
}
```

Elektroniikka

Kilpailuosio 1, piirilevyn suunnittelu (laserkortti)

Johdanto

Kilpailijan tehtävänä on suunnitella piirilevy annetun piirikaavion, ulkoisten mittojen sekä osaluettelossa lueteltujen komponenttien mukaan. Kilpailija saa käyttää suunnittelussa vapaasti valittua piirisuunnitteluohjelmaa. Suunnittelun tulos arvioidaan kilpailijan tuottaman paperitulosteen ja piirilevytiedostojen (gerberit) perusteella.

Tehtävän kuvaus

Suunnittele yksipuolinen piirilevy annetun piirikaavion (liite 1) mukaan. Käytettävät porakoot ovat tälle piirilevylle 1,0 mm, 1,3 mm, 3,3 mm, 4,0 ja 6,0 mm.

Layoutissa sallitaan kaksi hyppylankaa. Näiden hyppylankojen tulee olla joko vaaka- tai pystysuunnassa ja ne eivät saa ylittää toisia komponentteja tai toisiaan. Ylimääräiset hyppylangat vähentävät kokonaispistemäärää. Myös kilpailijan mahdollisesti lisäämät nollaohmivastukset tulkitaan hyppylangoiksi.

Piirikortti tullaan kiinnittämään kohdelaitteeseen. **Kortin koko on 49 x 37 mm**. Katso kuvaa 1 liittimien ja kiinnitysreikien sijoittelusta. Jätä 3,3mm kiinnitysreikien ympärille 3,5mm ja 6mm reiän ympärille 4,0mm säteittäinen tyhjennysalue (reiän keskipisteestä mitattuna).

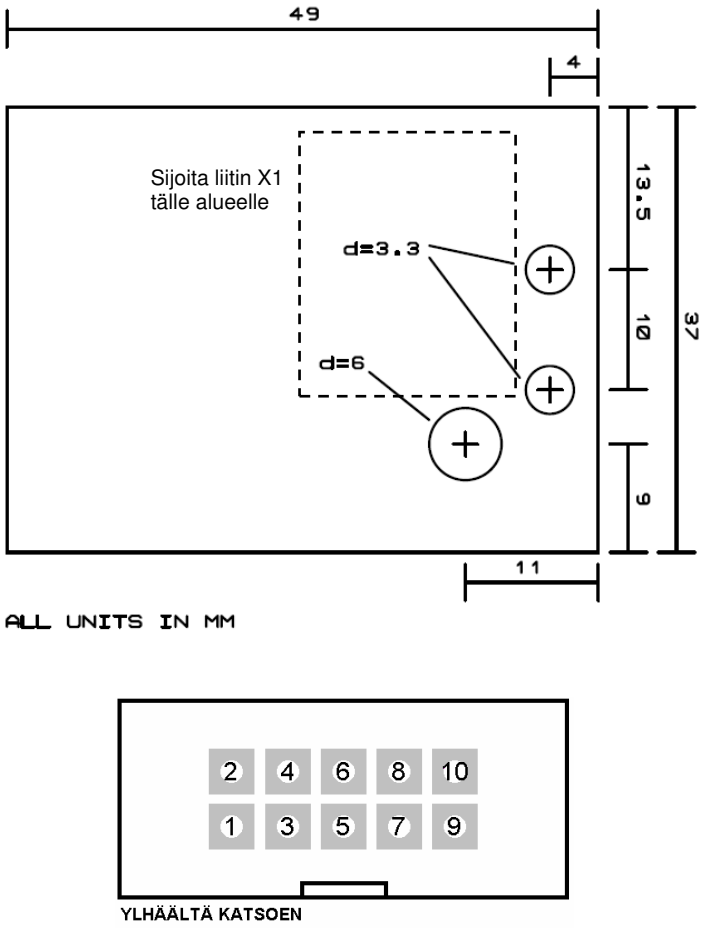
Sinun tulee kiinnittää huomiota komponenttien oikeaan nimeämiseen piirikaaviossa annettujen tietojen mukaan. Valmiissa layoutissa liittimen X1 paikan tulee vasta kuvassa 1 annettu määrettä.
Tekstit ja merkinnät eivät saa peittää komponenttien paikkoja, porausreikiä tai juotostäpliä. Sijoita nimikirjaimesi ja kilpailunumero levyn kuparipuolelle sopivaan paikkaan.

Liittimien nastat nimetään vasemmalta oikealle. Toisin sanoen, jos katsot liittimiä edestä, vasen kontaktinasta on ykkönen. Varmista, että liittimen johdotus vastaa piirikaaviossa annettua numerointia. Piikkirimaliittimien numerointi kuvan 1 ohjeessa esitettyä järjestystä vastaavasti.

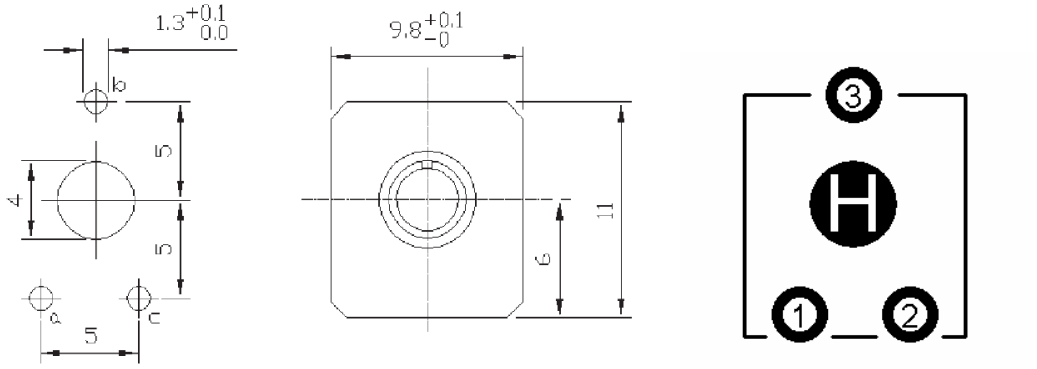
Jotta piirilevyn jyrsintä onnistuu kunnolla, käytä riittävästi tilaa, jotta saa johdoista riittävän leveitä. Käyttöjännite (24V) ja maapisteet tulee olla vähintään 0,38 mm (15 mils) ja muut johtimet vähintään 0,3 mm (12mils) leveitä. On myös mahdollista vetää yksi kupariveto liittimen jalkojen välistä, mutta tällöin pitää varmistaa että eristysalue on vähintään 0,20 mm (8 mils).

Komponentin piirilevykuvion mitoittaminen ja luominen

Uusi komponentti on kytkennässä käytetty trimmeripotentiometri. Voit luoda piirilevykuvion joko kirjastokomponenttina, tai jos komponentin kirjastoon luominen ei ohjelmallasi onnistu, niin voit tehdä juotostäplistä mitoituksen mukaisen jalkakuvion. Pääasia on, että kortilla on oikein mitoitettu asennuskuvio ja johdotus vaaditulle komponentille. Muista myös komponentin ”keskellä” oleva 4mm reikä ja komponentille sopiva silkkipainokuvio.



Kuva 1. Kiinnitysreikien sijoittelu ja liittimen jalkajärjestys (yksiköt millimetreissä).



Kuva 3. Käytetyn trimmeripotentiometrin mitat ja piirilevykuvio (yksiköt millimetreissä).

Ohjeita kilpailijalle

Tee valmiista piirilevystä osasijoittelukuva tuloste. Osasijoittelukuva tulostetaan 1:1 kokoisena A4 -paperiarkille. Käytät tätä tulostetta piirikortin komponenttien kalustuksessa ja asennuksessa kokoamisohjeena. Tulosteessa pitää näkyä piirilevyn ääriviiva, komponenttien piirroskuvat, komponenttien kytkentäkaavionimet sekä oma kilpailijanumerosi ja nimikirjaimet.

Tulosta arviointia varten 1:1 kokoinen tuloste, jossa samassa kuvassa näkyy sekä osasijoittelu- että piirilevykuva. Tulosteessa pitää näkyä kilpailijanumerosi ja nimikirjaimesi.

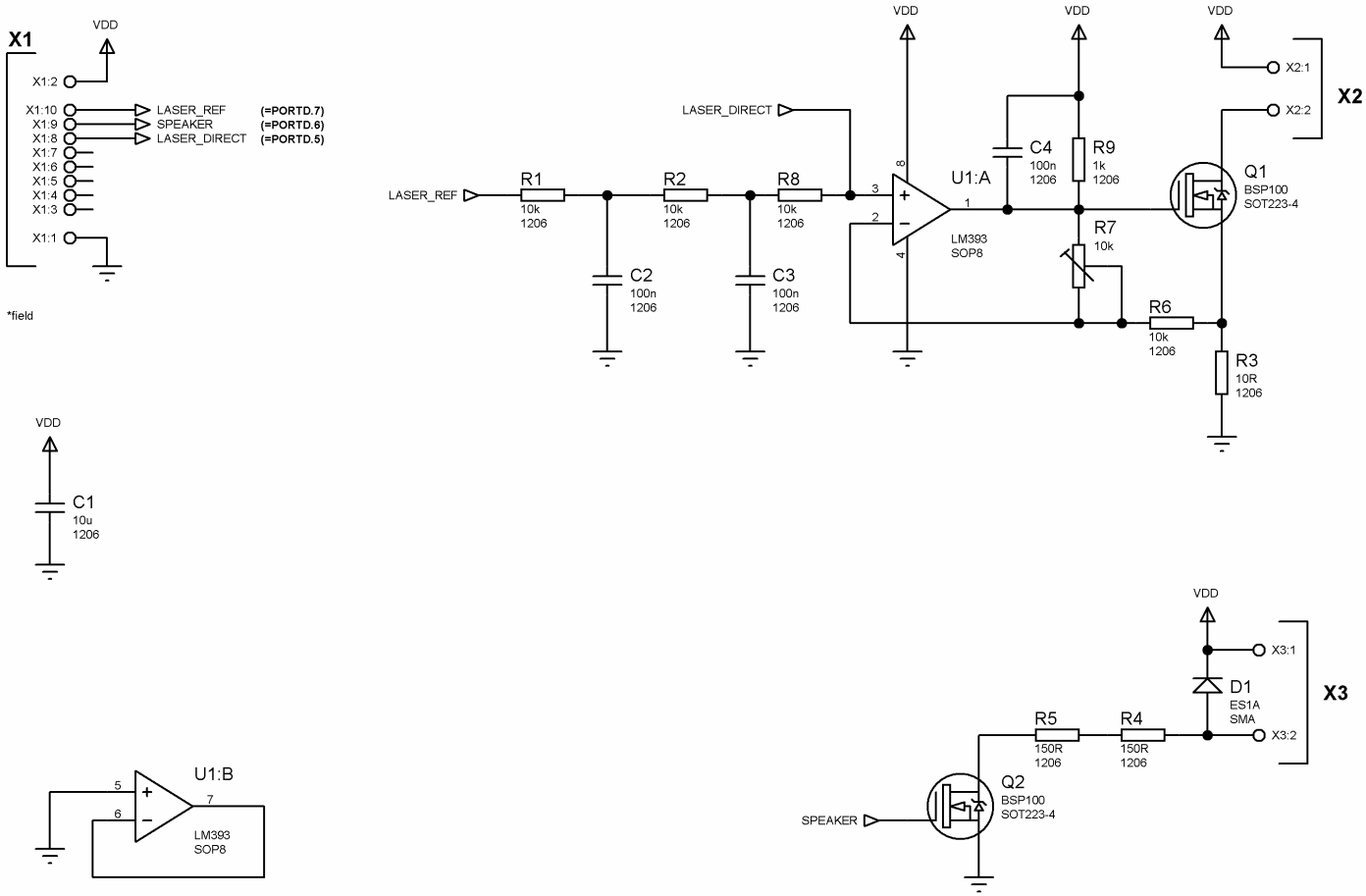
Anna muistitikulle talletettuna tarvittavat piirilevyn valmistustiedostot.

Katso osatietoja liitteenä olevasta osaluettelosta!

Arviointikohteet

Arviointi-kohteen tyyppi O = Obj S = Sub	Arviointikohde - Nimi tai lyhyt kuvaus	Vain objektiiviselle arvioinnille		Pisteet
		Tavoitearvo	Lisätietoa - (Lisää uuden rivin arviointikohteen alle)	
O	Kuparivetojen oikeellisuus	IPC-A-610 D	Kaikki komponentit, kaikki solmupisteet OK	**4,00**
O	Suunnittelun laatu, johdinleveydet ja reiät	IPC-A-610 D	Johtimen leveydet ja etäisyydet, hyppylangat, reikien koot	**4,00**
O	Suunnittelun laatu, uusi komponentti	IPC-A-610 D	Piirilevykuvio, reiät ja silkkipaino OK	**4,00**
O	Suunnittelun laatu, yleisilme, loogisuus	IPC-A-610 D	Kuinka hyvä ja käytännöllinen suunnittelu	**4,00**
O	Työn viimeistely	Gerber-files	Piirilevyn jyrsimiseen liittyvät määritykset (saadaan piirilevyn valmistusdokumenteista)	**4,00**

Liite 1. Suunniteltavan levyn piirikaavio.



Liite 2. Suunniteltavan levyn osaluettelo.

Total Parts In Design : 20

9 Resistors

Quantity:	References	Package	Value
4	R1, R2, R6, R8	1206	10k
1	R3	1206	10R
2	R4, R5	1206	150R
1	R7	TRIMMER_CB10V	10k
1	R9	1206	1k

4 Capacitors

Quantity:	References	Package	Value
1	C1	1206	10u
3	C2-C4	1206	100n

1 Integrated Circuits

Quantity:	References	Package	Value
1	U1	SOP8	LM393

2 Transistors

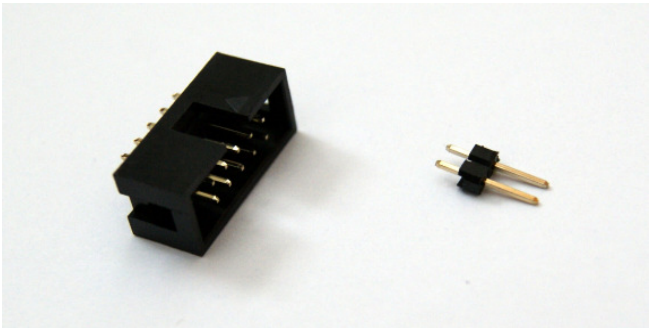
Quantity:	References	Package	Value
2	Q1, Q2	SOT223-4	BSP100

1 Diodes

Quantity:	References	Package	Value
1	D1	SMA	ES1A

3 Miscellaneous

Quantity:	References	Package	Value
1	X1	2X5_2.5_VERT	2x5 pin header, 2.54mm pitch
2	X2, X3	CONN-SIL2	2 pin header, 2.54mm pitch



Kuvassa vasemmalla liitin X1, oikealla liitin X2 / X3.

16.4.2010

Sulautetun järjestelmän ohjelmointi, Labyrinttipeli

Kilpailulaitteena toimii Jari Koskisen ja Ville Viitalan suunnittelema ”sokko” labyrinttipeli. Kilpailulaitteen käyttöliittymä koostuu kahdesta 5x7 pistematriisinäytöstä, neljästä painonapista ja piezo-summerista. Pelin ideana on löytää reitti alkupisteestä loppupisteeseen ”sokkona”, eli pelaaja ei näe missä seinät ovat. Pelaaja joutuu ”tunnustelemaan” reittiään edetessään. Pelaajan törmätessä seinään laite antaa äänimerkin, ilmaisten käyttäjälle ettei tunnusteltuun suuntaa voida edetä. Jokaisesta seinään osumisesta tulee yksi virhepiste. Pelaajan päästessä maaliin näyttää peli virhepisteiden määrän ja aloittaa pelin alusta.

Laitteen ohjelmointitehtävä

Tehtävänäsi on tehdä ohjelma kyseiselle kortille. Tehtävä etenee vaiheittain. Saatuasi osion valmiiksi pyydä tuomaria paikalle, joka tarkastaa laitteen toiminnan osion kohdalta. Älä etene tehtävissä ennen kuin tuomari antaa siihen luvan. Jos et saa jotain osiota tehtyä, niin voit pyytää tuomarilta valmista vastausta osioon, mutta menetät kyseisen osion pisteet. Lopuksi palautat C-kielisen ohjelmakoodi listauksen, johon olet kirjoittanut nimesi ja koulun nimen.

Kortti on valmiiksi asetettu toimimaan sisäisellä kellolla 1 MHz taajuudella. Mikro-ohjaimen JTAG-liitäntä on myös poistettu käytöstä. Näin ollen sulake-bitteihin (fuse bits) ei tarvitse koskea.

Jos kilpailija vahingossa ohjelmoi sulake-bitit sellaiseen tilaan, ettei kortti enää ohjelmoidu, saa hän tuomarilta uuden kortin, mutta häneltä vähennetään tällöin yksi piste.

Vaihe 1a. Kirjallinen tehtäväpaperi (0-1p)

Vastaa erillisellä paperilla olevaan kirjalliseen tehtävään ensin. Saatuasi kirjallisen osion valmiiksi pyydä tuomari paikalle. Tuomari antaa tämän jälkeen luvan edetä tehtävässä.

ÄLÄ ETENE TEHTÄVÄSSÄ ENNEN KUIN OLET PALAUTTANUT KIRJALLISEN OSION

Vaihe 1b. Laitteen toimintakunnon toteaminen (0-2p)

Sinun tulee tehdä kortille testiohjelma, joka soittaa piezo-summeria siten, että summeri soi 5 ms ja on sammuksissa 200 ms.

Tehtyäsi ohjelman pyydä tuomari paikalle ja osoita hänelle ohjelman toimivuus. Vasta tuomarin annettua luvan voit jatkaa eteenpäin.

Vaihe 2. Ledin sytyttäminen näytöllä (0-3p)

Sinun tulee tehdä kortille ohjelma, jolla saadaan yksi led kerrallaan palamaan näytöllä. Ledin asettamista varten tee funktio ”setLed()”. Funktion tulee ottaa vastaan arvot rivi ja sarake. Jos funktiolle annetaan virheellinen rivi tai sarake, ei silloin tehdä mitään. Palautusarvoa funktiolla ei ole.

Tehtyäsi funktion pyydä tuomari paikalle ja osoita hänelle funktion toimivuus vaihtamalla ohjelmassa rivin ja sarakkeen arvoa, jolloin saadaan haluttu led syttymään näytöllä. Tuomarin annettua luvan voit jatkaa eteenpäin.

Vaihe 3. Näppäimistön lisääminen ohjelmaan (0-3p)

Muokkaa edellistä ohjelmaasi siten, että haluttua palavaa lediä voidaan siirtää näytöllä painonäppäimien avulla. Yritettäessä siirtää lediä näytön reunan yli, päästää laite lyhyen äänimerkin (noin 5 ms).

Käytä kytkinvärähtelyn poistoa ohjelmassasi.

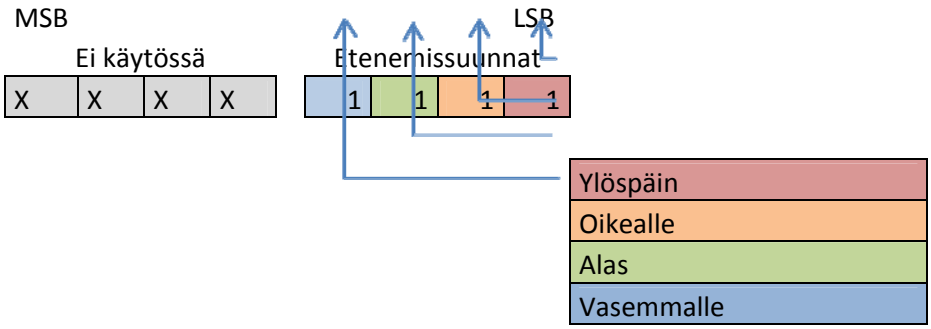
Tehtyäsi muutoksen pyydä tuomari paikalle ja osoita hänelle näppäimien toimivuus. Tuomarin annettua luvan voit jatkaa eteenpäin.

Vaihe 4. Labyrintin seinien luominen (0-3p)

Ota käyttöön ohjelmassasi taulukko johon on määritetty labyrintin seinät. Taulukko on kaksiulotteinen. Jokaisella ledillä on oma solu taulukossa. Solussa neljä alinta bittiä kertovat mihin suuntaan solusta voidaan edetä. Mahdollinen etenemissuunta on merkitty taulukkoon 1 tilassa olevalla bitillä. Jos pelaaja liikkuu päin seinää, päästää laite äänimerkin.

Alin bitti kertoo voidaanko mennä ylöspäin.
2. bitti kertoo voidaanko mennä oikealle.
3. bitti kertoo voidaanko mennä alaspäin.
4. bitti kertoo voidaanko mennä vasemmalle.

Saatuasi labyrintin toimimaan, pyydä tuomari paikalle. Tuomarin annettua luvan voit jatkaa seuraavaan tehtävään.



Esimerkiksi jos taulukon solussa on arvo 0x0A (0000 1010) tarkoittaa se, että kyseisestä kohdasta voidaan liikkua vasemmalle tai oikealle.

Vaihe 5. Virhepistelaskurin luominen (0-3p)

Sinun tulee tehdä ohjelmaasi virhepistelaskuri, joka näyttää virhepisteiden määrän pelaajan päästyä maaliin. Pistelaskurin tulee ”rullata” ensimmäisestä ledistä (vasen, yläkulma) alkaen rivi kerrallaan oikeaan virhepistemäärään. Ledien ”rullauksen” viive on 100 ms. Jos virhepisteitä on enemmän kuin näyttöön mahtuva määrä, laite vilkuttaa viimeistä lediä yli menevien pisteiden verran. Tällöin ledi on sammuksissa noin 20 ms ja palaa noin 80 ms. Virhepisteiden tulee näkyä näytöllä niin kauan, kunnes pelaaja painaa mitä tahansa näppäintä, jonka jälkeen alkaa uusi peli.

Nimi:_____ Kilpailija numero:_____

Ohjelmointitehtävän kirjallinen osio

Palauta tämä tehtävä tuomarille, kun olet vastannut kysymyksiin.

Mitkä ovat mikro-ohjaimen porttien alustukset (hex-lukuna), kun kytkimillä pitää olla ylösvetovastukset, piezo-summeri ei saa soida ja yksikään ledi ei pala näytössä?

PORTA = _____

DDRA = _____

PORTB = _____

DDRB = _____

PORTC = _____

DDRC = _____

PORTD = _____

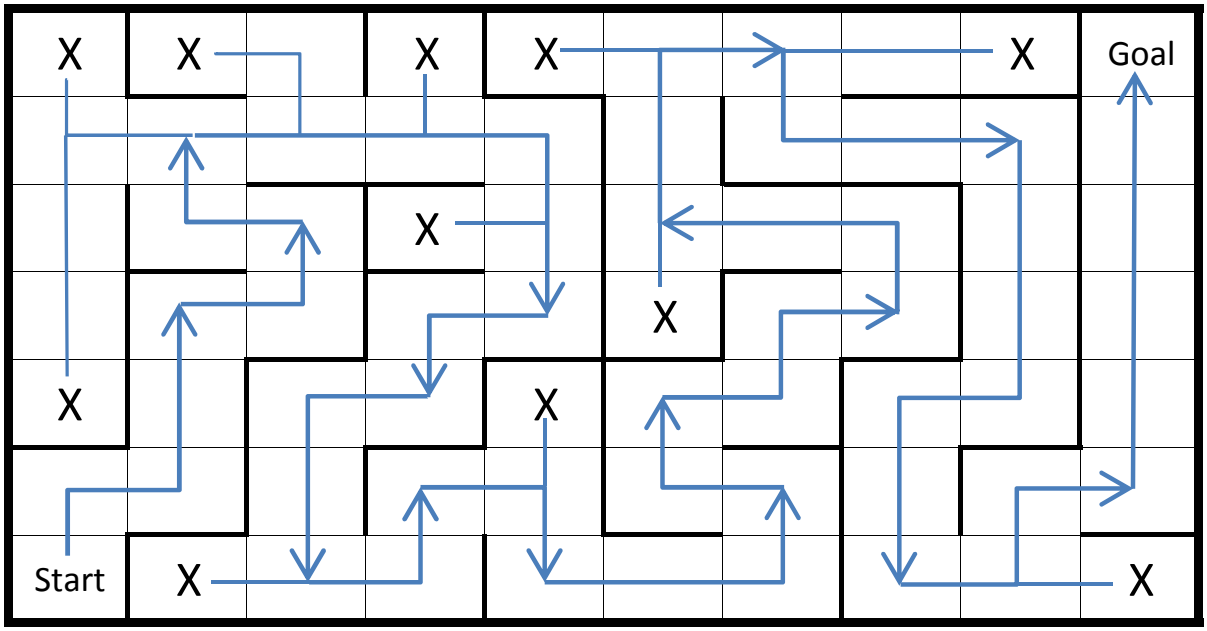
DDRD = _____

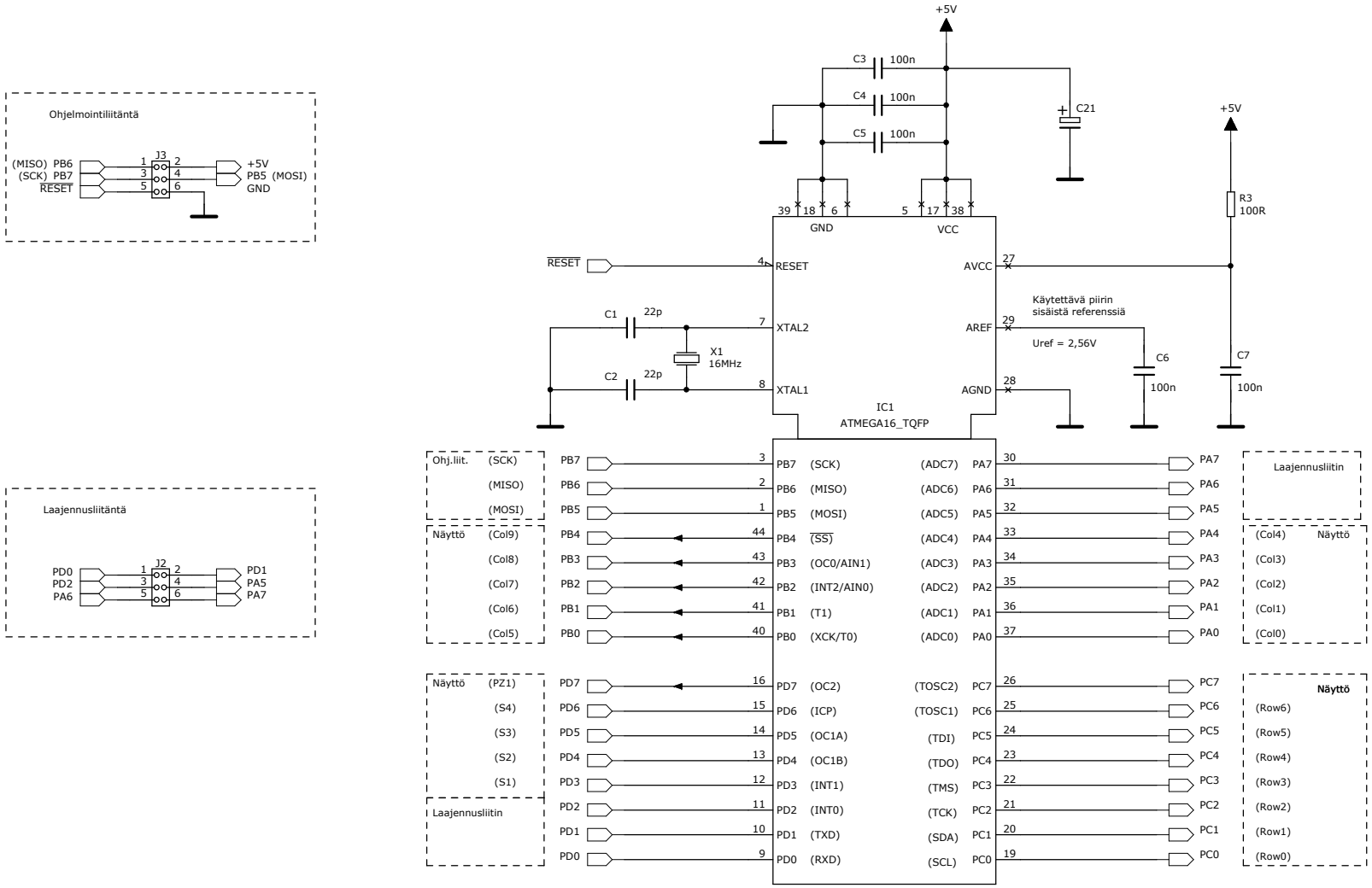
Pääyhteistyökumppanit: Electrolux, Toyota, NRJ, ISS, Teknologia teollisuus, jalas, Oulu inspiroi, S-Ryhmä

Järjestämässä: Oulun seudun ammattiopisto, osekk, Luovi, OAKK, Oulun seudun ammattikorkeakoulu

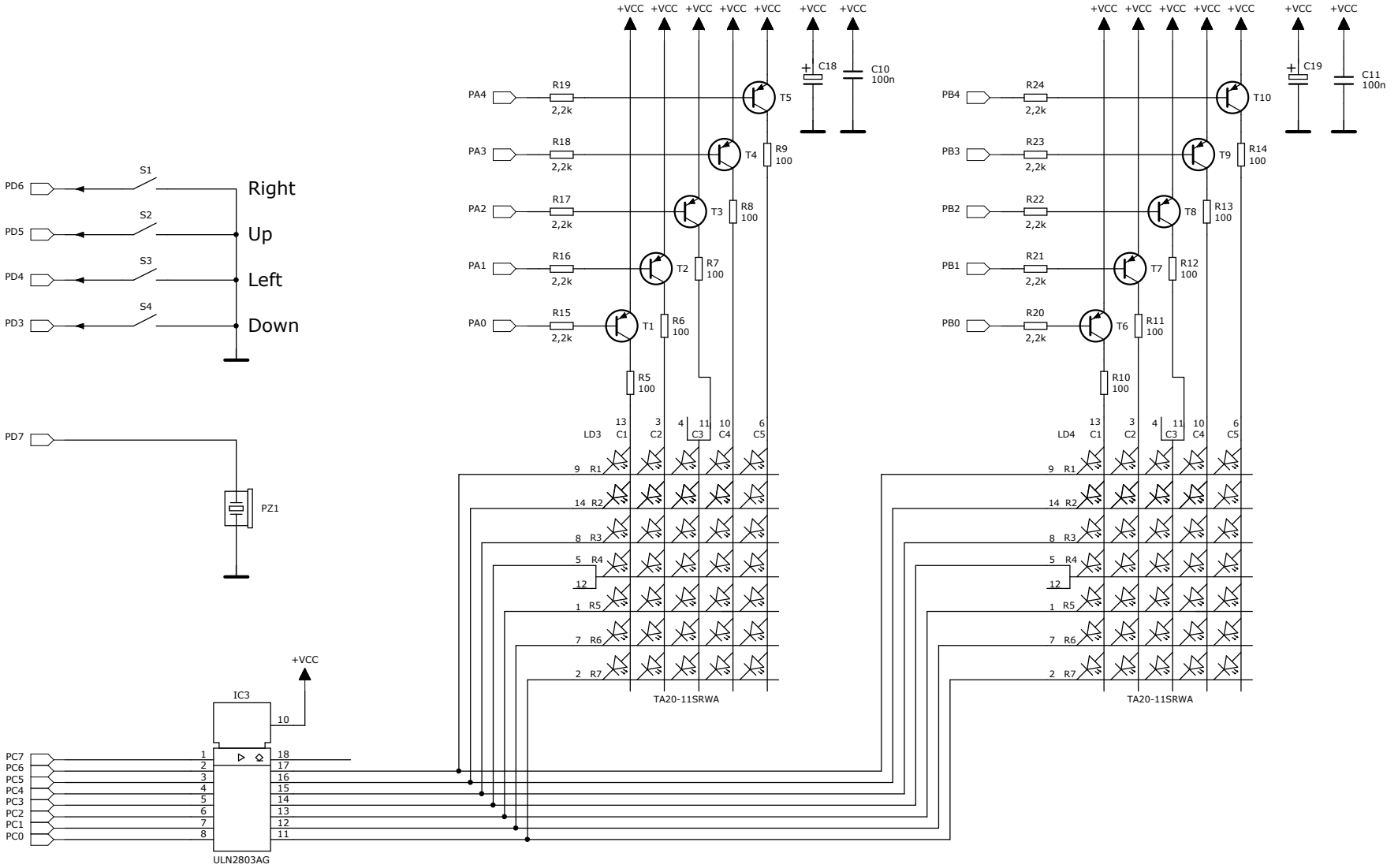
Labyrintin alustukset

```
PORTA = 0x1F;          // xxx1 1111
DDRA  = 0x1F;          // xxxo oooo

PORTB = 0x1F;          // xxx1 1111
DDRB  = 0x1F;          // xxxo oooo

PORTC = 0x00;          // x000 0000
DDRC  = 0x7F;          // xooo oooo

PORTD = 0x78;          // 0ppp pxxx
DDRD  = 0x80;          // oiii ixxx
```

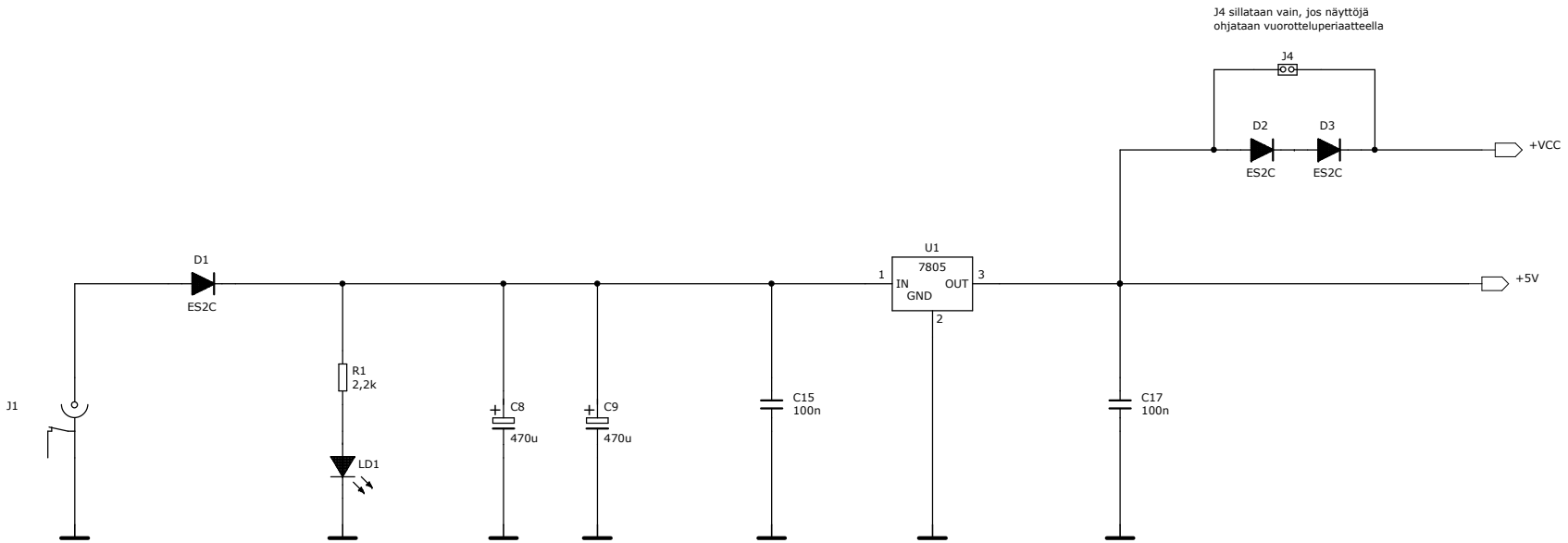

X
X
X
X
X
Goal
X
X
X
X
Start
X
X



Tietomyrsky Oy	
http://www.tietomyrsky.fi	
DRAWN: JKo	DATED: 240310
CHECKED: VVi	DATED: 230410
TITLE: Laby1	
CPU	



		Tietomyrsky Oy	
		http://www.tietomyrsky.fi	
DRAWN: JKo	DATED: 240310	TITLE: Laby1	
CHECKED: VVi	DATED: 230410		DISPLAY



			Tietomyrsky Oy http://www.tietomyrsky.fi
DRAWN: JKo	DATED: 240310	TITLE:	Laby1
CHECKED: VVi	DATED: 230410		

```
/*********************************************************************
Project:        Labyrintti
Author:         Ville Viitala
Company:        MacGyver Technologies
Date:           29.03.2010
Version:        2.0
*********************************************************************/
#include <util/delay.h>
#include <avr/io.h>

/*********************************************************************/
/* Kytkentöjen määritykset                                           */
/*********************************************************************/

#define ROWS            PORTC                   // Rivit on kytketty C-porttiin
#define COLLOW          PORTB                   // 5 alinta saraketta A-porttiin
#define COLHIGH         PORTA                   // ja 5 ylintä B-porttiin

#define UP                      ~PIND&(1<<PD5)  // Nappi ylöspäin       PD5
#define LEFT            ~PIND&(1<<PD4)  // Nappi oikealle       PD4
#define DOWN            ~PIND&(1<<PD3)  // Nappi alaspäin       PD3
#define RIGHT           ~PIND&(1<<PD6)  // Nappi vasemmalle PD6

#define ANY_KEY         (UP || LEFT || DOWN || RIGHT)

#define PIEZO           0x80                    // Piezo PD7

/*********************************************************************/
/* Etenemissuuntien maskit ja julkiset muuttujat                     */
/*********************************************************************/

#define MOVE_UP         0x01                    // Ylöspäin
#define MOVE_RIGHT      0x02                    // Oikealle
#define MOVE_DOWN       0x04                    // Alaspäin
#define MOVE_LEFT       0x08                    // Vasemmalle

unsigned char points;                           // Virhepisteet
unsigned char row, col;                         // Sarake ja rivi

/*********************************************************************/
/* Labyrintin asetukset                                              */
/*********************************************************************/

const unsigned char labyrintti[7][10] = {
        {0x04, 0x02, 0x0C, 0x04, 0x02, 0x0E, 0x0E, 0x0A, 0x08, 0x04},   // Rivi
0
        {0x07, 0x0E, 0x0B, 0x0B, 0x0C, 0x05, 0x03, 0x0A, 0x0C, 0x05},   // Rivi
1
        {0x05, 0x03, 0x0C, 0x02, 0x0D, 0x07, 0x0A, 0x0C, 0x05, 0x05},   // Rivi
2
        {0x05, 0x06, 0x09, 0x06, 0x09, 0x01, 0x06, 0x09, 0x05, 0x05},   // Rivi
3
        {0x01, 0x05, 0x06, 0x09, 0x04, 0x06, 0x09, 0x06, 0x09, 0x05},   // Rivi
4
        {0x06, 0x09, 0x05, 0x06, 0x0D, 0x03, 0x0C, 0x05, 0x06, 0x09},   // Rivi
5
        {0x01, 0x02, 0x0B, 0x09, 0x03, 0x0A, 0x09, 0x03, 0x0B, 0x08}    // Rivi
6
        };

//        0             1         2             3         4             5
 6              7         8             9
//      Sarakkeet

/*********************************************************************/
```

```
/* Funktioiden prototyypit                                                */
/**************************************************************************/

/* Asettaa ledin kerrallaan palamaan halutulta riviltä ja sarakkeelta */
void setLed(unsigned char row, unsigned char col);

/* Äänimerkki */
void beep(void);

/* Näyttää virhepisteet näytöllä */
void dspScore(void);

/* Aloittaa uuden pelin */
void startNewGame(void);

/**************************************************************************/
/* Pääohjelma                                                             */
/**************************************************************************/

int main(void)
{
        PORTA = 0x1F;   // xxx1 1111
        DDRA  = 0x1F;   // xxxo oooo

        PORTB = 0x1F;   // ppp1 1111
        DDRB  = 0x1F;   // iiio oooo

        PORTC = 0x00;   // x000 0000
        DDRC  = 0x7F;   // xooo oooo

        PORTD = 0x78;   // 0ppp pxxx
        DDRD  = 0x80;   // oiii ixxx

        startNewGame(); // Aloitetaan uusi peli

        while(1)
        {

        /* Painettu ylöspäin */
                if(UP)
                {
                        _delay_ms(10);                  // Kytkin värähtelyn
poistoa

                        if((row > 0) && (labyrintti[row][col] & MOVE_UP))
// Jos emme ole ylimmällä rivillä ja -
                        {
                                // on mahdollista liikkua ylöspäin
                                row--;                          // Vähennetään
riviä (noustaan)
                                setLed(row,col);        // Uusi ledi palamaan
                        }
                        else                                    // Jos ei ole
mahdollista edetä ylöspäin
                        {
                                beep();                         // PIIP! ja
                                points++;                       // virhepiste
                        }

                        while(UP)                               // Odotellaan
että nappi
                                asm("nop");                     // päästetään
ylös (askel kerrallaan)

                        _delay_ms(10);                  // Kytkin värähtelyn
poistoa
```

```
		}

	/* Painettu alaspäin */

		if(DOWN)
		{
			_delay_ms(10);			// Kytkin värähtelyn
poistoa
			if((row < 6) && (labyrintti[row][col] & MOVE_DOWN))
// Jos emme ole alimmalla rivillä ja -
			{
					// on mahdollista mennä alaspäin
				row++;				// Lisätään
riviä (laskeudutaan)
				setLed(row,col);	// Uusi ledi palamaan
			}
			else					// Jos ei ole
mahdollista edetä alaspäin
			{
				beep();				// PIIP! ja
				points++;			// virhepiste
			}

			while(DOWN)				// Odotellaan
että nappi
				asm("nop");			// päästetään
ylös (askel kerrallaan)

			_delay_ms(10);			// Kytkin värähtelyn
poistoa
		}

	/* Painettu vasemmalle */

		if(LEFT)
		{
			_delay_ms(10);			// Kytkin värähtelyn
poistoa
			if((col > 0) && (labyrintti[row][col] & MOVE_LEFT))
// Jos emme ole vasemmassa reunassa ja -
			{
					// on mahdollista mennä vasemmalle
				col--;				// Vähennetään
saraketta
				setLed(row,col);	// Uusi ledi palamaan
			}
			else					// Jos ei ole
mahdollista mennä vasemmalle
			{
				beep();				// PIIP! ja
				points++;			// virhepiste
			}

			while(LEFT)				// Odotellaan
että nappi
				asm("nop");			// päästetään
ylös (askel kerrallaan)

			_delay_ms(10);
		}

	/* Painettu oikealle */

		if(RIGHT)
		{
			_delay_ms(10);			// Kytkin värähtelyn
poistoa
			if((col < 9) && (labyrintti[row][col] & MOVE_RIGHT)) //
```

```
Jos emme ole oikeassa reunassa ja -
                        {
                                        // on mahdollista mennä oikealle
                                col++;                          // Lisätään
saraketta
                                setLed(row,col);        // Uusi ledi palamaan
                        }
                        else                                    // Jos ei ole
mahdollista mennä oikealle
                        {
                                beep();                         // PIIP! ja
                                points++;                       // virhepiste
                        }

                        while(RIGHT)                    // Odotellaan että nappi
                                asm("nop");                     // päästetään
ylös (askel kerrallaan)

                        _delay_ms(10);                  // Kytkin värähtelyn
poistoa
                }

        /* Päästy labyrintin loppuun */

                if((row ==0) && (col == 9))     // Ollaanko lopetus pisteessä?
                {
                        dspScore();                             // Näytä
virhepisteiden määrä
                        while(!ANY_KEY)                 // Odotellaan ANY KEY:tä
                                asm("nop");
                        while(ANY_KEY)
                                asm("nop");
                        _delay_ms(10);
                        startNewGame();                 // Uusi peli käyntiin
                }

        }
 }

/*********************************************************************/
/* Funktio joka sytyttää yhden ledin kerrallaan näytöllä
*/
/*********************************************************************/

void setLed(unsigned char row, unsigned char col)
{
                unsigned char mask = 0x01;                              //
Apumuuttuja jota tarvitaan -

        // rivien ja sarakkeiden käyttöön.
                if((row <= 6) && (col <= 9))                    // Löytyvätkö
annetut arvot näytöltä?
                {
                        col = 9 - col;
// Sarakkeet ovat "väärinpäin" porteissa, -

        // joten joudutaan laskemaan lopusta päin.
                        COLHIGH |= 0xFF;
// "Sammutetaan" -
                        COLLOW  |= 0x1F;
// kaikki sarakkeet

                        ROWS = mask << row;
// Asetetaan haluttu rivi päälle

                        mask = 0x01;
// Uudelleen asetetaan apumaski.
                        if(col < 5)
```

```
// Jos sarake on alle 5, niin -
                                COLLOW  = ~(mask << col);               //
käytetään PORTA:ta sarakkeiden ohjaamiseen

                        else
// Jos sarake on yli 5, niin -
                                COLHIGH = ~(mask << (col - 5)); // käytetään
PORTB:tä ohjaamiseen
                }
}

/*********************************************************************/
/* Funktio, joka näyttää virhepisteet näytöllä
        */
/*********************************************************************/

void dspScore(void)
{
        unsigned char i;
        for(i=0; i<points;i++)          // Lähdetään rullaamaan pistemäärää -
        {                                                       // näytölle.
                if(i<69)                                        // Jos kyseinen piste
löytyy vielä näytöltä...
                {
                        setLed(i/10,i%10);      // Lasketaan riville ja
sarakkeelle arvo virhepisteistä ja -
                        beep();                                 // piipataan
                        _delay_ms(100);         // Sopiva rullausviive.
                }

                else                                            // Jos nykyinen piste ei
ole enään näytöllä...
                {
                        ROWS &= 0x00;           // Sammutetaan ledit
                        COLHIGH |= 0xFF;
                        COLLOW  |= 0x1F;
                        _delay_ms(20);          // Odotetaan lyhyt hetki.
                        setLed(6,9);            // Sytytetään viimeinen ledi ja
piipataan -
                        beep();                                 // ja odotellaan
lyhyempi viive, jotta rullauksen
                        _delay_ms(80);          // tahti (ääni) ei muuttuisi
paljoa.
                }

        }
}

/*********************************************************************/
/* Funktio, joka soittaa piezo summeria
                */
/*********************************************************************/

void beep(void)
{
        PORTD |= PIEZO;         // Piezo päälle.
        _delay_ms(8);           // Lyhyt viive, jotta ehditään piipata.
        PORTD &= ~PIEZO;        // Piezo pois.
}


/*********************************************************************/
/* Funktio, joka aloittaa uuden pelin efektin kanssa
*/
/*********************************************************************/

void startNewGame(void)
{
```

```
        unsigned char i;
        points = 0;                             // Virhepisteet nollille.
        row = 6;                                // Aloituspaikat: rivi 6 (0...6)
        col = 0;                                // Sarake 0 (0...9)

        for(i=0;i<10;i++)                   // Luodaan efekti, joka
        {                                                   // vilkuttaa aloitus-
kilpailussa)
                ROWS &= 0x00;               // lediä 10 kertaa (tämä ei ollut
                COLHIGH |= 0xFF;            // tämä on siis extraa...
                COLLOW  |= 0x1F;
                _delay_ms(100);

                setLed(row,col);
                _delay_ms(100);
        }
}
```

Myllytullin yksikkö 19.1.2010
Jouni Lievonen

Lajikuvaus TAITAJA 2010-01-19

Elektroniikka
Teollisen laitteen rakentaminen

Kilpailutehtävän pohjana on OUMAN EH-203 lämmönsäädin

1. Kilpailussa kootaan EH-203 elektroninen säätölaite
   - näyttö/näppäinyksikön kokoonpano
   - piirikorttien testaus testausjärjestelmällä
   - asiakasohjelmien asennus
   - laitteen kokoonpano

2. EH-203 säätölaitteen asennus ja kytkentä
   - simulaatiovastusten asentaminen (ulkoanturi, menovesianturi)
   - relelähdön kaapelointi
   - hälytyskytkimen kaapelointi
   - gsm-modeemin kytkeminen
   - SYÖTTÖKAAPELIN KYTKENTÄ (Sähköturvallisuus 230 V AC)

3. EH-203 säätölaitteen käyttöönotto
   - relelähdön, digitaalitulon ja tekstiviestiasetusten konfigurointi
   - hälytyksen kuittaus ja releen ohjaus gsm-puhelimella

4. EH-203 säätölaitteen käyttöönotto
   - EH-net palvelimen avulla
   - Web-palvelin on valmiiksi konfiguroitu

Ohjeita:
Kilpailijalla pitää olla GSM puhelin
Kilpailija voi tutustua EH-203 lämmönsäätimen käsikirjaan www.ouman.fi sivuilta. Erityisesti yleiskytkentäkaavioon. Tutustu myös rele, hälytys gsm ja web ohjeisiin. Laitteen voi halutessaan hankkia OUMAN:lta.

EH-203

User manual

Heating regulator

OUMAN EH-203 is a new generation heating regulator. Its versatility, intelligence and clarity have made it an ideal heating regulator for all kinds of water circulation heating systems.

In addition to heating regulation, EH-203 has a number of other control and alarm functions of buildings' technical systems.
Measurement information can be read, settings and controls can be checked and adjusted, and alarms can be received and acknowledged via a GSM telephone's text messages.

EH-203 gives its user instructions on a display.

Types of heating systems:
- Radiator heating
- Floor heating
- Air conditioning preregulation
- Hot water regulation

PATENTED GSM CONTROL

LONWORKS®

MODBUS ®

Types of heating production:
- District heating exchangers
- Boiler plants
- Accumulators
- District heating substations

Locations:
- Apartment buildings and row houses
- Business premises and office buildings
- Private homes and summer cabins

OUMAN®

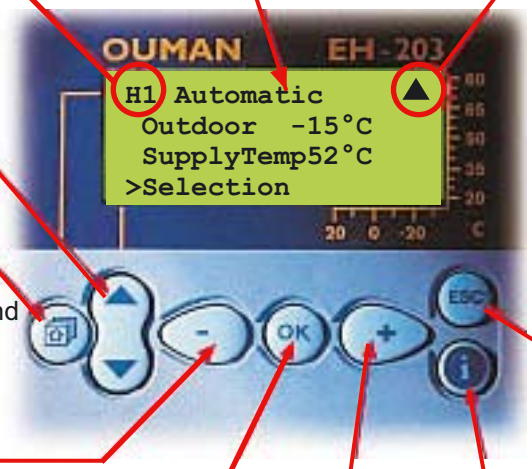
Ouman EH-203 is a multifunctional heating controller which is adaptable to many different types of heating systems. Ouman EH-203 has the ability to control two heating circuits and one hot water control circuit simultaneously. Your controller's display changes depending on the connections and selected functions that are in use. All the different functions are presented in this user manual. In the beginning we present the basic principles for using the controller.

User panel

Regulating circuit code indicates the regulating circuit in question (heating circuit H1 shown here).

Browse button - moves the > cursor up and down.

Group select button - moves you from one regulating to the next. The regulating circuits are: H1, heating regulating circuit, H2, heating regulating circuit and HW, domestic hot water regulating circuit.



Symbols which indicate actuator control mode.

- Regulator opens the 3-point controlled actuator.
- Regulator closes the 3-point controlled actuator.
- Height up the pillar shows the position of the voltage controlled actuator.
- Valve is fully open (100%) and the control voltage is 10 V.
- Valve is fully closed (0%) and the control voltage is 0 V or 2 V (2 ... 10 V actuator).

Decrease button

OK button

Increase -button

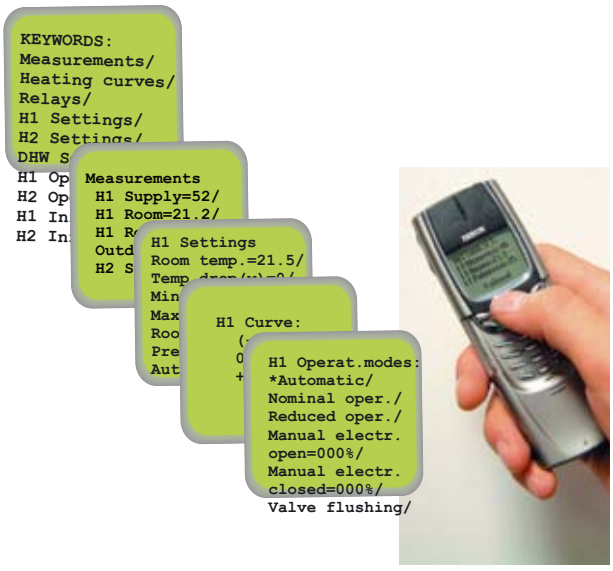
ESC press to return to the previous display

INFO-button -gives operating instructions and additional information on the display in different situations.

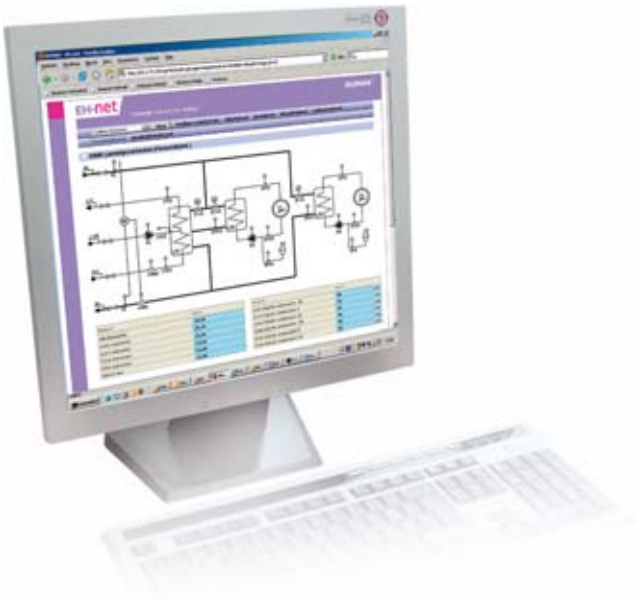
HINT! When you press + button in adjoining basic display mode, the regulator displays all the measure-ment results in turn and then returns to the basic display mode.

Remote control options:

Remote control via a GSM phone
Most of EH-203's user level functions can also be carried out via GSM phone text messages.



Web based user interface
Ouman controllers can also be controlled and monitored via an inexpensive web user interface. A web scanner is easy to use and can illustrate remote control and monitoring of even large Ouman control systems regardless of the time and place.



Text message use is illustrated on page 20.

OUMAN EH-203

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Maintenance guide

These pages contain directions for maintenance persons authorized by Ouman. Access to the regulator´s maintenance mode is prevented by a maintenance mode.

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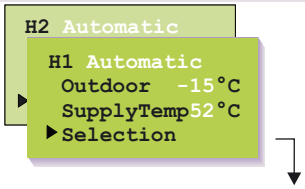
OUMAN EH-203 SETTINGS FOR HEATING CURVE

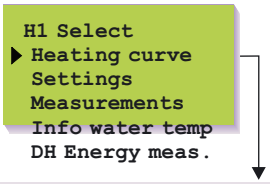
The correct shape for the characteristic heating curve depends on many factors (the insulation in a house, type of heat distribution, the dimensions of the piping, etc.). A heating curve is typically set so that the supply water temperature rises when the outdoor temperature drops. **Ouman EH-203's characteristic heating curve can be adjusted to exactly fit the needs of the facility from either three or five points. A 3-point curve is a factory setting. A 5-point curve can be taken into use in the special maintenance mode. (see p. 33).**



OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.
Press **OK.**

Use the button to move from one regulating circuit to the next (H1, H2).

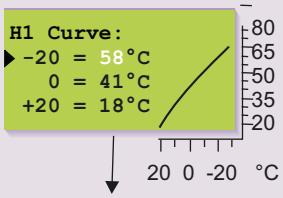


Press the button to move cursor to "Heating curve"
Press **OK.**

Hint!! *Adjustable values are white in color.*

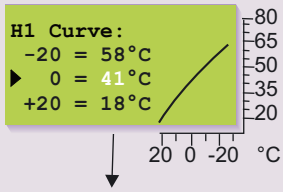
3-point curve (factory setting): You can adjust the characteristic heating curve using outdoor temperature settings - 20°C, 0°C and +20°C. EH-203 prevents you from setting characteristic heating curves that are the wrong shape. It automatically proposes a correction.

Adjustment point 1

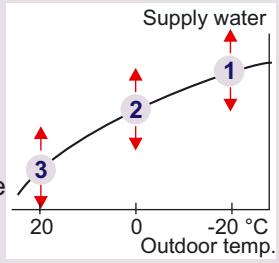


Press **OK.** Press the **-** or **+** button to set the supply water temperature at an outdoor temperature of -20 °C.
Press **OK.**
Press the button to move to the next adjustment point..

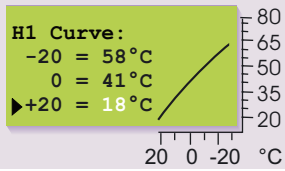
Adjustment point 2



Press **OK.** Press the **-** or **+** button to set the supply water temperature at an outdoor temperature of 0 °C. Press **OK.**
Press the button to move to the next adjustment point..



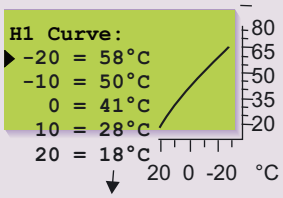
Adjustment point 3



Press **OK.**
Press the **-** or **+** button to set the supply water temperature at an outdoor temperature of -20 °C.
Press **OK.**
Exit with **ESC.**

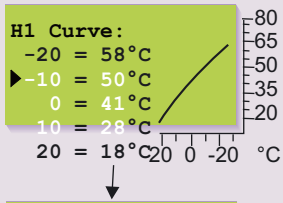
5-point curve (taken into use in special maintenance see p. 33): You can adjust the characteristic heating curve using outdoor temperature settings -20°C and +20°C as well as three other outdoor temperature settings between -20°C - +20°C. **Note! Automatic characteristic heating curve proposed correction is not in use!**

Adjustment point 1

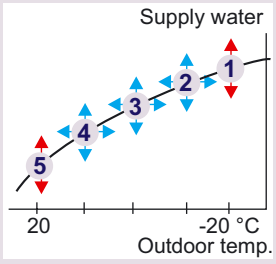


Press **OK.** Press the **-** or **+** button to set the supply water temperature at an outdoor temperature of -20 °C. Press **OK.**
Press the button to move to the next adjustment point..

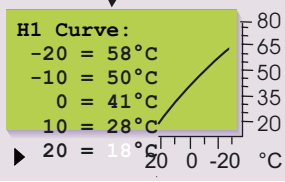
Adjustment points 2-4



Press **OK.** Press the **-** or **+** button to set the outdoor temperature for which you want to determine the supply water temperature. Press **OK**. Press the **-** or **+** button to set the supply water temperature for the outdoor temperature in question. Press **OK**. . Press the button to move to the next adjustment point..



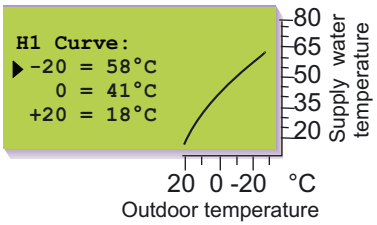
Adjustment point 5



Press **OK.**
Press the **-** or **+** button to set the supply water temperature at an outdoor temperature of -20 °C.
Press **OK.**
Exit with **ESC.**

Instructions for setting the curve

CURVE INTERPRETATION:



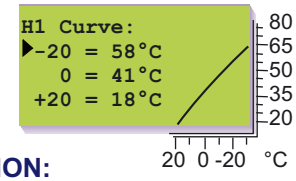
When the outdoor temp. is:
-20 °C, the supply water is +58 °C
0 °C, the supply water is +41 °C
+20 °C, the supply water is +18 °C

Attention!

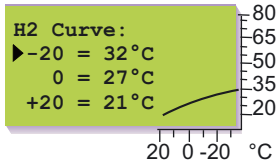
The temperature of the supply water may vary from the curve if a reduced operation mode, room, wind or sun compensation has been connected to the regulator or if one of the limiting functions limits the temperature (see p. 10).
If the outdoor sensor is disconnected or if the sensor is broken, the regulator assumes that the outdoor temperature is 0 °C (use during construction without the outdoor sensor).

EXAMPLES OF DIFFERENT HEATING SYSTEMS:

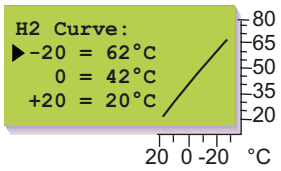
a) Normal radiator network (H1 circuit, factory setting)



B) Floor heating



C) Preheating for air conditioning (H2 circuit, factory setting)

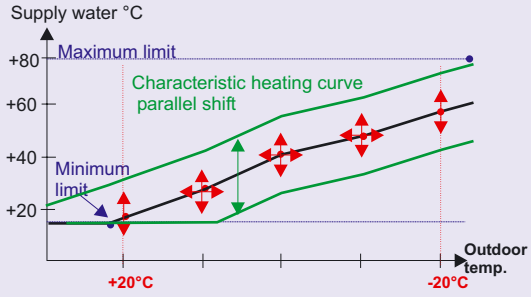


INSTRUCTION:

If the room temperature drops in sub zero weather, raise the curve setting at -20 °C.
If the room temperature rises in sub zero weather, lower the curve setting at -20 °C.
If the room temp. feels chilly at zero degree weather, raise the curve setting at 0 °C.
In this way you can set the regulating curve to meet the heating needs of your facility.

Parallel shift:
If the room temperature remains constant, but it is either too cold or too hot, the characteristic heating curve can be moved using a parallel shift. The number of degrees of the parallel shift indicates the amount the characteristic heating curve is moved on the supply water temperature scale.
Note! Wait for a sufficient length of time after the settings have been adjusted so the adjustment has time to effect the room temperature.

5-POINT CURVE:



The 5-point characteristic heating curve bisects 5 adjustment points. In addition, the supply water temperature can be limited by setting minimum and maximum limits for the supply water. (see p. 6).

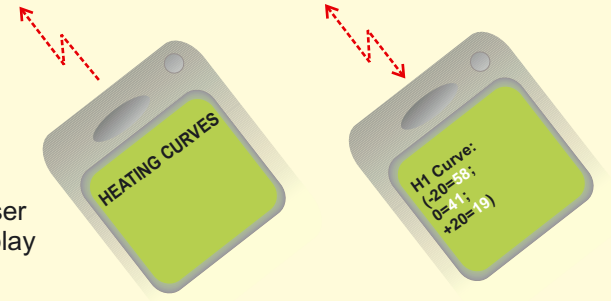
With a 5-point curve, the supply water temperatures are set for outdoor temperatures -20°C and +20°C. In addition, three other outdoor temperatures can be set between -20°C and +20°C that are given supply water temperatures.

The supply water temperature setting range is +5°C … +120°C for each adjustment point.

PATENTED GSM CONTROL

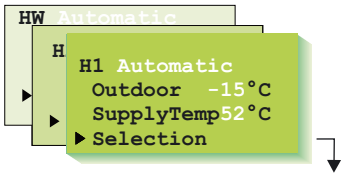
KEYWORDS:
Heating curves
H1 Heating curve
H2 Heating curve

Note! The graphic user interface cannot display the 5-point curve.



SETTINGS Browsing, making changes

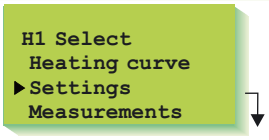
In Ouman EH-203 the regulator is controlled by many different settings. Settings are selected according to sensor connections and relay control modes (e.g., is a relay controlling the oil burner or pump or is the relay temperature controlled see p. 26-27). By browsing you can see which settings you have in use. Browsing and setting changes occur in the following way:



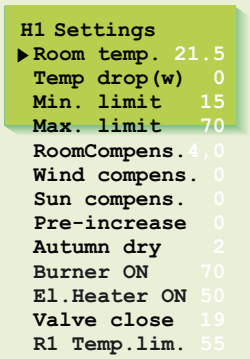
OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.

Press **OK.** Press the button to move from one regulating circuit to the next (H1, H2, HW).



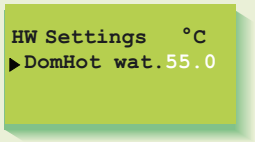
Press the button to move cursor to "Settings". Press **OK.**



Changing the heating regulating circuit setting:

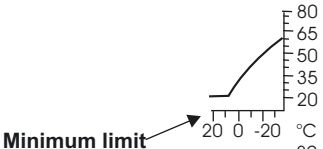
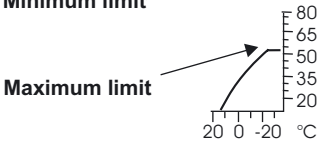
Press the button to move the cursor to the setting that you want to change. Press **OK.**
Press the **-** or **+** button to change the setting. Press **OK.**
Exit with **ESC.**

Changing the domestic hot water temperature:

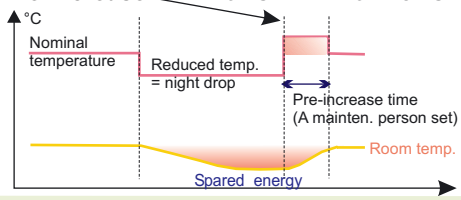
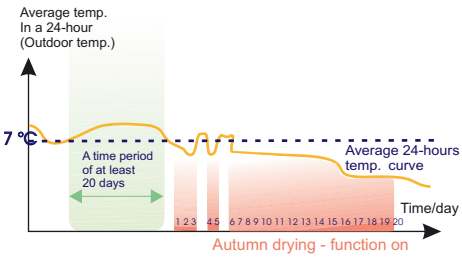


Use the button to move to domestic hot water regulating circuit (HW). Press **OK.**
Press the **-** or **+** button to change the setting.
Press **OK.** Exit with **ESC.**

INFORMATION ABOUT SETTINGS:

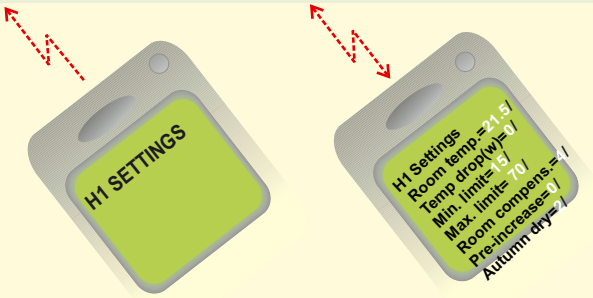
Settings:	Factory settings:	Range:	Explanation:	Attention!
Room temp.	21,5°C	5.0...45.0°C	Room temperature setting, which user has set.	During temp. drop period regulator use the calculated room temp. setting, which is **Room temp. -** Temp drop(w) / Room compens.
Temp drop (w) (supply water)	0°C	0...35°C	The supply water temperature drop, determined by the clock program or the external home/away switch. (Room compensation takes a desired drop in room temperature into account)	
Min. limit	15°C	5...95°C	Minimum allowed supply water temperature. Set the minimum limit for floor heating circuit tiled floors between 20...25°C, to ensure a comfortable temperature and removal of moisture in the summer.	
Max. limit	70°C	20...125°C	Maximum allowed supply water temperature. The maximum limit prevents the temperature in the heating circuit from rising too high, preventing damage to pipes and surface materials. If, e.g., the characteristic heating curve setting is incorrect, the maximum limit prevents excessively hot water from entering the network. Set the upper limit for floor heating between 35...40°C.	
Parall.shift	0°C	-15...+15°C	A parallel shift occurs when a change in supply water temperature occurs at each adjustment point.	
Room compens.	4.0°C	0.0...7.0°C	Room compensation ratio: If the room temperature is different than what it is set at, the room compensation corrects the supply water temperature. (Eg.) If the room compensation is 4 and the room temperature has risen 1,5 °C above the setting, the regulator drops the supply water temperature 6 °C (4x1,5 °C =6 °C)	**Room sensor** (TMR) must be connected (H1:meas.3, H2: meas. 6, or net). An appropriate room compensation ratio for floor heating is usually between 1.5 - 2.0°C.
Wind.compens.	0°C	-7...7°C	A house cools down in windy weather. In that case the wind compensation raises the supply water temperature. The reading indicates the maximum amount that the wind compensation can raise the supply water temperature. Wind compensation can also be used as a general compensation, e.g., sun compensation. In that case give a negative setting!	**Wind sensor** must be connected, the same sensor for regul. circuits H1 and H2 (meas. 6 or net).

Additional information about settings

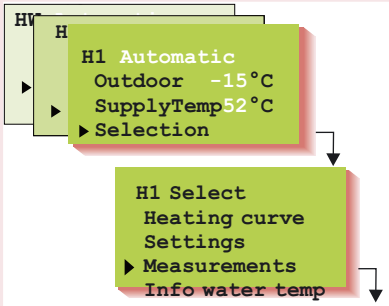
Settings:	Factory settings:	Range:	Explanation:	Attention!
Sun compens.	0 °C	0...-7 °C	The room temperature of a house having large windows with a south exposure rises on a sunny day even in subzero weather. The reading indicates the maximum amount that the sun compensation can drop the supply water temp.	The sun measurement can only be read from the net. Sun compensation is the same for control circuits H1 and H2.
Pre-increase 	0 °C	0...25 °C	The automatic pre-increase in degrees which occurs after a reduced operation (nighttime drop) The pre-increase makes it possible to raise the room temperature faster to a nominal room temperature (day temp.) after a reduced operation. A maintenance person must set the length of the pre-increase time (see maintenance mode p 23).	
Autumn dry  Average temp. In a 24-hour (Outdoor temp.) 7 °C A time period of at least 20 days Average 24-hours temp. curve Time/day 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Autumn drying - function on	2 °C	0...15 °C	In autumn, the temperature of the supply water is automatically raised for 20 days through autumn drying. Autumn drying is activated when the average temperature in a 24-hour period has continually been above 7 °C for a period of at least 20 days and after this drops below 7 °C. Autumn drying is activated during the next 20 days whenever the average temperature in a 24-hour period is under 7 °C. The autumn drying setting indicates how much autumn drying raises the supply water temperature. The original factory setting is 2 °C.	
Burner ON	70 °C	5...95 °C	When the temperature of measurement 10 drops to the set limit, the regulator causes relay 1 to turn the burner on (see p. 26).	Select relay 1 for burner control.
El.Heater ON	50 °C	5...95 °C	When the temperature of measurement 10 drops to the set limit, the regulator causes relay 2 to switch on the heating resistor (see p. 27).	Select relay 2 for heating resistor control.
Valve close	19 °C	5...50 °C	Valve closed during the summer: The outdoor temperature limit at which the regulator closes the valve/valves. A factory setting is that only the valve in the H1 circuit closes. If the maintenance person has selected "H1 Valve regul or H2 Valve regul" under pump summer stop, the function is not on in that particular circuit. Select "H1 (H2) Valve close" in pump summer stop for that function to be on (see p. 25).	If heating pump control has been selected for relay 1's control function, this setting becomes the pump's summer stop limit.
Pump stop	19 °C	5...50 °C	Pump summer stop: Outdoor temperature at which the regulator stops the pump. During connection and installation, the maintenance person decides whether to stop both the H1 and H2 circuit pumps and whether the valves will continue regulating or whether they will close (each of the valve's functions is determined separately, see maintenance mode page 26).	Pump stop appears in place of the valve summer close setting if heating pump control has been selected in the relay 1 control mode (p. 25).
R1 Temp.lim.	55°C	0...100°C	The temp. of measurement 11 where relay 1 is active.	Can be set when relay1 is selected to temp. operated function (p.26).
DomHot wat.	55.0°C	5.0...95.0°C	Domestic hot water temperature setting. Because of danger of bacteria, it is recommended that the domestic hot water temperature is not set below +55°C.	

PATENTED GSM CONTROL

KEYWORDS:
H1 Settings
H2 Settings
DHW Settings



The regulator can be connected to 14 different measurement data at the same time (11 NTC measurements + 3 digital inputs).Measurement data can also be read through the bus. Also the position of the voltage controlled (0...10V or 2...10V) actuator can be seen. Measurements 6, 9, 10, and 11 can be used to indicate external alarms (additional information on alarms page 18) ATTENTION! **Only the measurements connected to the regulator appear on the display.**

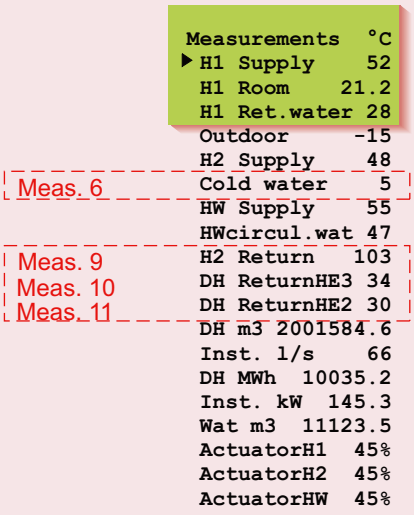


OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.
When you press the **+** button in the basic display mode, the regulator displays all the measurement results in turn and then returns to the basic display mode.
You can also browse measurement data in the "Measurements" display.

Press **OK.**

Press the ▲▼ button to move cursor to "Measurements". Press **OK.**



Browsing through measurements:

Press the ▲▼ button to browse different measurements.
Press **ESC** to exit from the measurements display

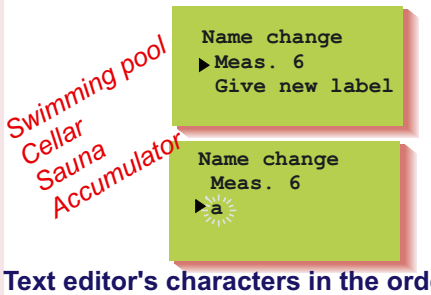
Every sensor has it's own typical range. (Eg. outdoor sensor 50...+ 50 °C). If the sensor's measured value is outside of this range, a - or + character will appear on the measurements display in place of the sensor's measured value to indicate whether the value is above or below the range.

If there is a sensor defect the regulator gives an alarm (see p. 18) and "err" will appear in place of the measured value.

Meas. 6: A free information type temperature measurement which can be labelled (the factory setting is cold water) or used as a measurement effecting control (H2 room or wind compensation, see special maintenance, p. 30).
Meas. 9: A free information type temp. measurement which can be labelled (the factory setting is H2 return water).
Meas. 10: A free information type temperature measurement which can be labelled (the factory setting is DH Return HE3). If relay 1 is reserved for burner control and/or relay 2 is reserved for heating resistor control, the controller uses meas. 10 as a temp. control measurement.
Meas. 11: A free information type temperature measurement which can be labelled (the factory setting is DH Return HE2). If relay 1 is controlled by a temperature controlled relay (see p. 26), the controller automatically reserves measurement 11 for relay 1 temperature measurement.

Relabeling measurements 6, 9, 10 and 11:

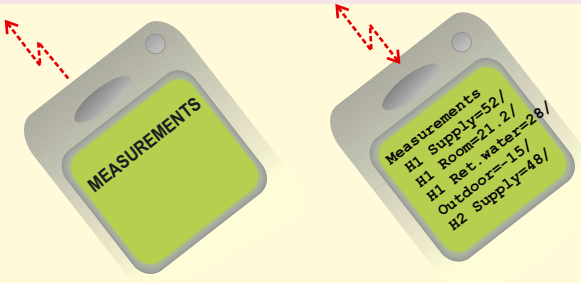
Move the cursor to the measurement (6, 9, 10 or 11) that has to be relabeled. Press **OK.**



Move the cursor to "Give new label". Press **OK.**
A letter "a" appears on the display. You can move forward or backward in the character row by pressing the **+** or **-** button. Confirm the letter/character by pressing **OK**, then the same letter/character that you selected will blink in the next space. The character that has been fed last can be deleted by pressing **ESC**. If you press the **ESC** button for a while you can delete the new name and the previous name remains in effect. When you have written the name, press **OK** for a while (over 2 sec.), to exit from the data entry mode and the name that has been written will come into effect.

Text editor's characters in the order in which they appear: "Empty" . - numbers 0... 9 letters A ...Z a … z ä ö å

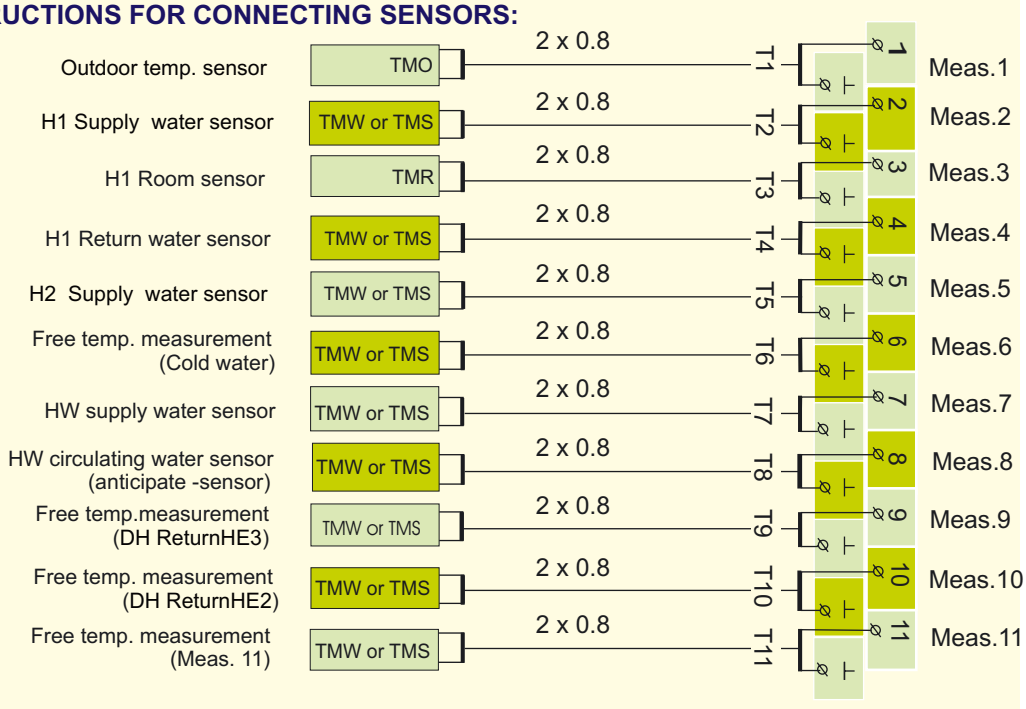
KEYWORD:
Measurements



MEASUREMENTS Additional information

Strip con-nector	Measure-ment:	Measurement information:	Setting range:	Attention!
1	Out temp	Outdoor temperature	-50...+50	Can be read through the net
2	H1 Supply	Supply water temperature in regulating circuit H1	0...+130	
3	H1 Room	Room temp. in regulating circuit H1 (room comp.)	-10...+80	Can be read through the net
4	H1 Ret.water	Return water temperature in regulating circuit H1	0...+130	
5	H2 Supply	Supply water temperature in regulating circuit H2	0...+130	
6	Cold water	Free measurement; name using the text editor	-10...+80	Interchangeable (p. 30). If several compens. are needed, the data must be read through the net and the wind is m/s and the light is lux (p. 36).
6	H2 Room	Room temp. in regulating circuit H2 (room comp.)		
6	Wind	Wind speed (% of sensor's range)		
6	Network pressure	Pressure in the heating network		
7	HW supply	HW (domestic hot water) supply water temp.	0...+130	
8	HW circul.wat	Temp. of HW return water in heat exchanger. (an anticip. sensor is used in the HW heat exchanger to improve the setting results)	-10...+80	
9	H2 Return	Free measurement; name using the text editor	0...+130	
10	DH ReturnHE3	Free temperature measurement that can be labelled or a measurement that controls the burner and/or heating resistor.	0...+130	Relay 1 controls the burner a nd relay 2 controls the heating resistor.
11	DH ReturnHE2	Free measurement; name using the text editor	0...+130	
	DH m3	Measured consumption of DH water (m^3)	0...99999,9	Consumption data can be read as digital inputs or through the net.
	Inst. l/s	Momentary district heating water consumption (l/s)	0...+120	
	DH Mwh	Measured energy consump. of DH water (MWh)	0...99999,9	
	Inst. KW	DH energy consumption in kW (5 min. period)	0...3276,7	
	Wat m3	Measured water consumption of facility (m^3)	0...99999,9	
	ActuatorH1	Actuator position in regulating circuit H1		Appears only when using a 0...10V (2...10V) controlled actuator.
	ActuatorH2	Actuator position in regulating circuit H2		
	ActuatorHW	Actuator position in regulating circuit HW		

INSTRUCTIONS FOR CONNECTING SENSORS:



Putting sensor into use and removing it from use:

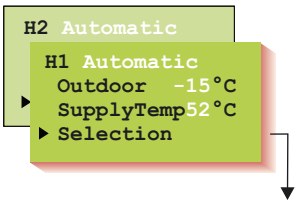
If the outdoor sensor is not connected, the regulator assumes that the outdoor temperature is 0°C and a sensor fault message appears on the display (Outdoor temp err). When the outdoor sensor is connected, the regulator automatically takes it into use. **After adding other sensors you must go to start function!** (See page 17)

Resistance value table

°C	Ω
-30	177 100
-25	130 400
-20	96 890
-15	72 830
-10	55 340
-5	42 340
0	32 660
5	25 400
10	19 900
15	15 710
20	12 490
25	10 000
30	8 064
35	6 531
40	5 330
45	4 368
50	3 602
55	2 987
60	2 490
65	2 084
70	1 753
75	1 482
80	1 259
90	917
100	680
110	511

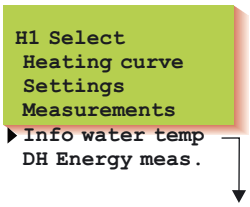
SUPPLY WATER INFORMATION

In this mode we can see which factors determined by the regulator make up the supply water temperature at the time of inspection.
The basis for this is the supply water temperature at the present outdoor temperature according to the characteristic heating curve.



OPERATING INSTRUCTION:

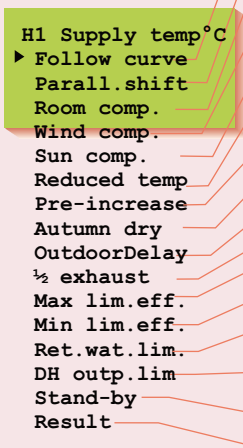
Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.
Press **OK.**
Press the button to move from one regulating circuit to the next (H1, H2).



Press the button to move cursor to "Info water temp". Press **OK.**

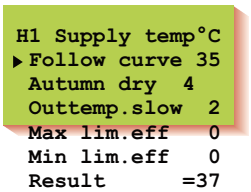
Press the button to browse factors which determine the supply water temperature.

Exit with **ESC.**



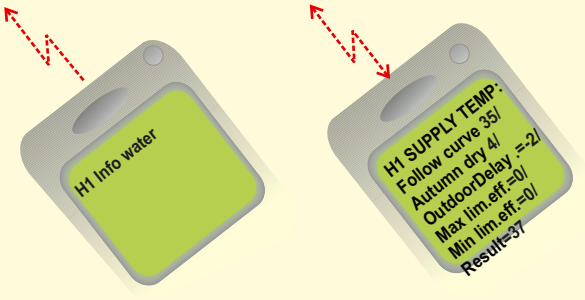
- Supply water temp. at the present outdoor temp. accord. to the curve
- The effect of a parallel shift on the supply water temperature.
- Room comp.: Effect of room compensation on supply water/ RoomCompNigh: Effect of room compensation on supply water during reduced operation.
- Effect of wind compensation on supply water
- Effect of sun compensation on supply water
- Effect of clock controlled reduced operation mode on supply water (or a drop controlled by a home/away switch or robot phone)
- Effect of pre-increase on supply water after reduced operation mode.
- Effect of automatic autumn drying on supply water
- Effect of outdoor temperature measurement delay on supply water
- Effect of exhaust fan at ½ power on supply water
- Supply water temperature drop due to maximum limit
- Supply water temperature increase due to minimum limit
- Effect of return water limits on supply water
- Effect of district heat power limit or flow limit on regulating circuit H1 supply water
- Effect of free temperature drop on supply water
- Present supply water temperature (C°) determined by the regulator

EXAMPLE



In the example, the supply water temperature according to the curve is 35 °C. Autumn drying raises it 4 °C. The outdoor temperature measurement delay drops the supply water temp. 2 °C. As a result, the regulator determines that the supply water temperature is +37 °C. (35+4-2=37).

KEYWORDS:
H1 Info water
H2 Info water



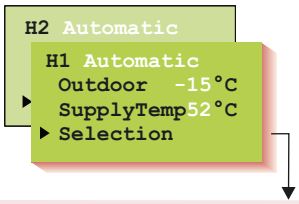
OUMAN EH-203 DISTRICT HEATING ENERGY MEASUREMENT

EMR-200 compatible energy meters:
- Kamstrup Multical 66 ja 401
- Enermet / Kamstrup 9EVL
- Enermet / Kamstrup 10EVL
  + opto-card
- Enermet / Kamstrup 11EVL

Measurement information from the district heating energy meter can be read to the Ouman EH-203 by using EMR-200 read head (optional equipment). Ouman EH-203 has a connector for the read head. The function is activated in the controller's special maintenance menu (see Energy meter p. 34).

Measurement information can be read from the controller's display and it can also be read from the net or as text messages, if these functions have been taken into use.

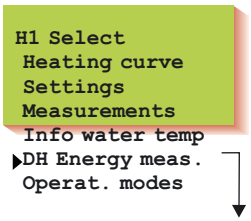
The EVL type district heating energy meter has only one serial port from which a reading can take place. If a wireless(Keithin ehdotus-hän sanoi että radioluku on hassu termi!) or modem is connected to it, it is not possible to use the EMR-200 at the same time! Kamstrup Multical 66 and 401 both have two serial ports so district heating energy meter measurement data can be read simultaneously, e.g., via a radio card or modem for the district heating centre or via EMR-200 for the caretaker.



OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.

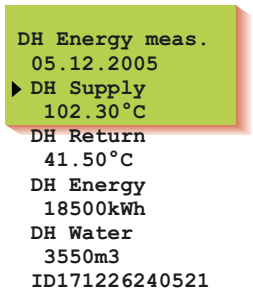
Press **OK.**



Press the button to move cursor to "Energy meas.". Press **OK.**

Press the button to browse measurement information received from the district heating energy meter.

Exit with **ESC.**



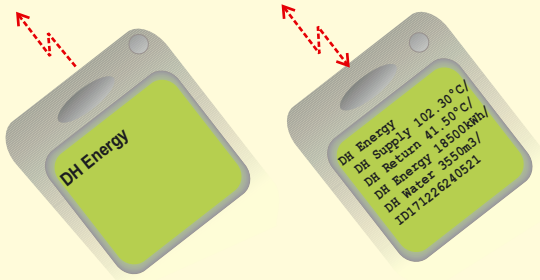
DH Supply:	Measured district heating supply water temperature (°C)
DH Return:	Measured district heat return water temperature (°C)
DH Energy:	District heating energy consumption meter reading (kWh)
DH Water:	District heating water consumption as a meter reading (m3)
ID:	District heating meter identification code reading from the district heating meter.

If "-" appears in place of the measurement value, the controller has not read the measurement information in question. The reason for this may be that the energy meter does not support this measurement.
"Momentary output" and "Momentary flow" energy meter measurements can be read from the controller's Measurements menu.

PATENTED GSM CONTROL

KEYWORDS:

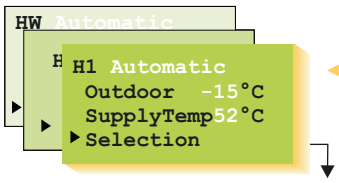
DH Energy
Measurements*)



Use the key word "DH ENERGY" to receive via text message the same measurement information that is in the controller's menu. The same text message can be automatically sent monthly on a selected day to two different GSM numbers. (e.g., a report to the electric company and caretaker). Instructions on p. 34 Energy meter.
*) Use the keyword "Measurements" to obtain information about the facility's district heating output and water consumption.

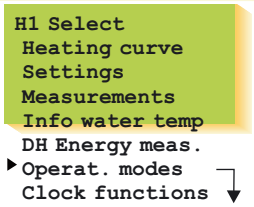
OPERATING MODES

Each regulating circuit can be controlled with the operating modes mentioned below. The factory set automatic regulation is a normal regulating situation in which the clock controlled temperature drops are also possible.
The selected operating mode always appears on the basic display on the top line.

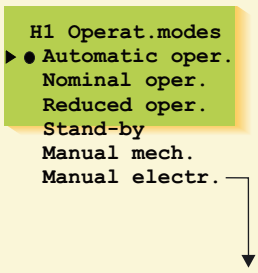


OPERATING INSTRUCTION:
Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.

Press **OK.**
Press the button to move from one regulating circuit to the next (H1, H2, HW).



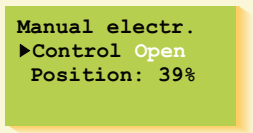
Press the button to move cursor to "Operat. modes". Press **OK.**



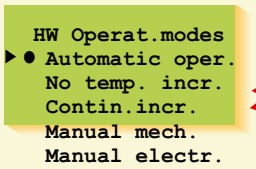
Press the button to browse operating modes.
The ● character indicates which operating mode has been selected.

Changing operating mode:
Move the cursor to the operating mode that you want. Press **OK.**
Exit with **ESC.**

Manual operation of actuator mechanically:
No electricity to actuator.
Only mechanical manual operation of actuator is possible.



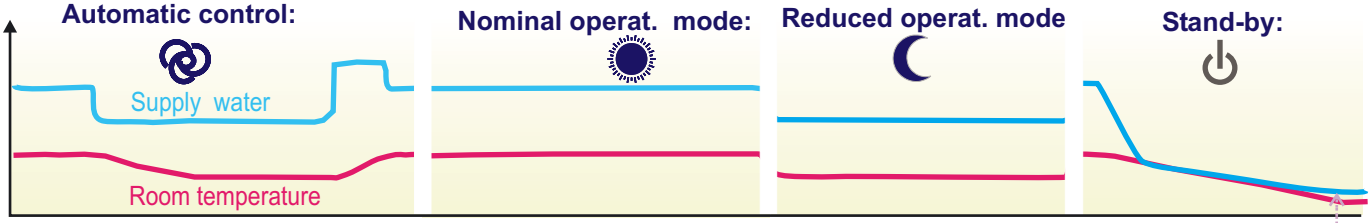
Manual operation of actuator electrically: Press **OK.**
Press the **-** or **+** button to change the position of the actuator.
The direction the actuator is being run can be seen from the display.
The position's %-reading indicates the actuator`s position if a voltage controlled 0...10V or 2...10V actuator (0% = closed, 100% = open) is being used. Confirm the actuator position by pressing **OK.**
The valve can also be connected so that 100% is closed.



Operating modes in domestic hot water regulating circuit (HW)

Press the button to move to the HW circuit. "No temp. incr." and "Contin. incr." can be selected from control modes after the amount of temperature increase has been given in maintenance mode settings (See p. 23 "HW increase").

Additional information about operating modes in heating regulating circuits H1 and H2:



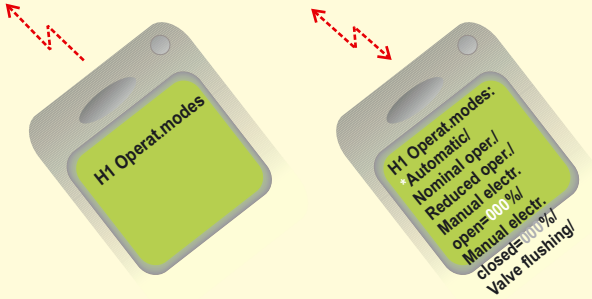
Temperature drops occur according to the clock program.

The regulator keeps a nominal temperature on disregarding the clock program.

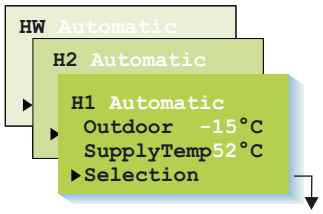
Continuous reduced temperature (nighttime drop) is on regardless of the clock program.

Free supply water temperature drop down to the freeze protect limit (stand-by function).

KEYWORDS:
H1 Operat.modes
H2 Operat.modes
DHW Settings



Setting the time happens in the following manner:

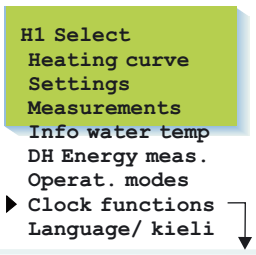


OPERATING INSTRUCTION:

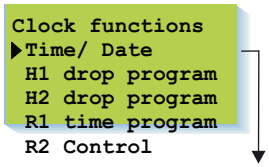
Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.

Press **OK.**

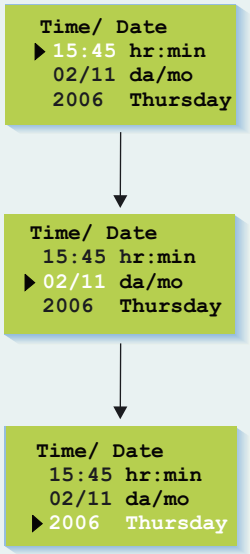
Press the button to move from one regulating circuit to the next (H1, H2, HW).



Press the button to move cursor to “Clock functions”. Press **OK.**



The cursor is at "Time/Date". Press **OK.**



Set the time:
The cursor is at time. Press **OK.**
The hours blink. Press the **-** or **+** button to set the hours. Press **OK.**
The minutes blink. Press the **-** or **+** button to set the minutes. Press **OK.**

Set the date: Press **OK.**
The day blinks. Press the **-** or **+** button to set the day. Press **OK.**
The month blinks. Press the **-** or **+** button to set the month. Press **OK.**

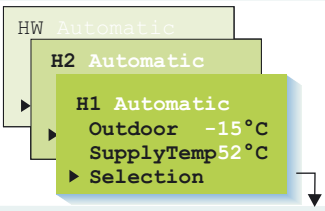
Set the year and weekday: Press **OK.**
The year blinks. Press the **-** or **+** button to set the year. Press **OK.**
The weekday blinks. Use the **-** or **+** button to set the weekday. Press **OK.**
Exit with **ESC.**

Attention!
The Ouman EH-203 regulator's clock registers summer time and standard time changes and leap years.
The battery lasts approx. 10 years.

Clock programs - browsing, adding, deleting

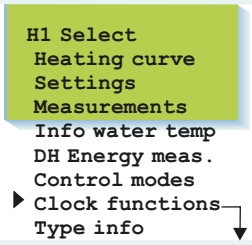
With the freely programmable 24 hour/7 day clock you can:

1. **Drop the temp. for certain lengths of time (heat. circuits H1 and H2)**
2. **Increase the domestic hot water temp. (anti-bacteria function)**
3. **Time control the desired on/off connections with two relays (eg. ventilator, outdoor lights, sauna stove, outside doors, see p. 15).**

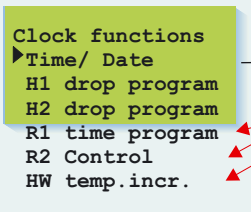


OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.
Press **OK.**



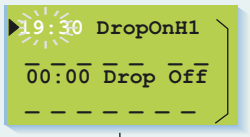
Press the button to move cursor to "Clock functions". Press **OK.**



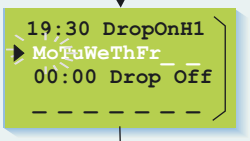
Press the button to move cursor to the regulating circuit (or relay control circuit) whose time controls you want to access (browse, add or delete). Press **OK.** Relay time control is in use when the relay in question is reserved first for time or time/outdoor temperature control (see p. 26-27) HW increase is in use when the amount of the HW increase has been set in the special maintenance mode, (see p. 23)

Browse/ location for additional programming:

Press the button to browse the clock programs which have been made. If you want to make additional programs, move cursor to first empty program block.



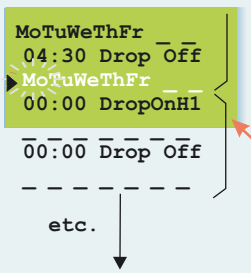
Set the start time for the temp. drop program: Press **OK.**
Temperature drop start time hours blink.
Press the **-** or **+** button to set hours. Press **OK.**
Minutes blink. Press the **-** or **+** button to set minutes. Press **OK.**



Set the weekdays (when the start time is effective):
Press the **-** or **+** button to select weekday.
The day is left unselected/ press the **-** -button to delete the selection.
The selection shown on the display is taken into use with the **OK** button.
Make your selection for each day and press **OK.**

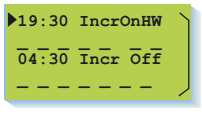
Set the end time for the temp. drop program: Press **OK.**
Hours blink. Press the **-** or **+** button to set hours. Press **OK.**
Minutes blink. Press the **-** or **+** button to set minutes. Press **OK.**

Set the weekdays (when the end time is effective):
Press the **+** button to select weekday.
The day is left unselected/ press the **-** to delete the selection.
The selection shown on the display is taken into use with the **OK** button.
Make your selection for each day and press **OK.**



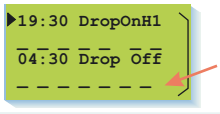
There is always one program block inside the brackets (drop on and off).
The cursor moves to the beginning of the next program block (new brackets).
Continue programming as before or exit with **ESC.**
In the example the drop is in effect during the workweek between 19:30 and 4:30. On the weekend the drop begins on Friday evening at 19:30 and ends on Monday morning at 4:30.

HW temp.incr.



Domestic hot water increase program:

Clock programming occurs in the same way as the temperature drop clock program.

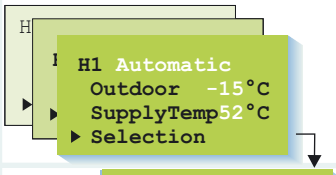


DELETING THE PROGRAM BLOCK:

You can delete the program block inside the brackets by deleting the weekdays in that program block with the **-** button.

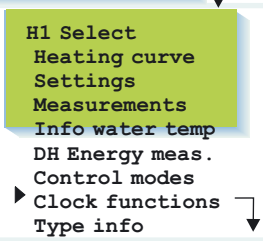
Clock functions; relay control

Relays can control many different functions, e.g., sauna stoves, locking doors etc. Relay clock functions are taken into use and labeled according to use in the relay control mode. (see p. 26 and 27). Then the relay can be controlled using a GSM, if a GSM-modem has been installed into the regulator (optional equipment).

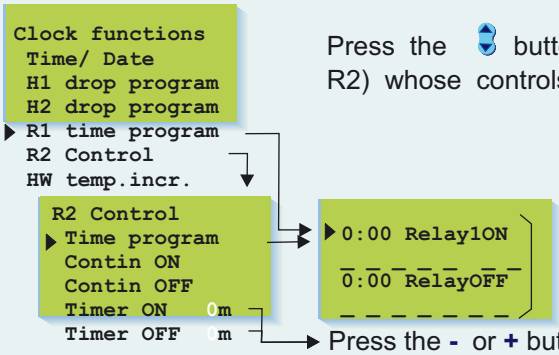


OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.
Press **OK.**



Press the button to move cursor to "Clock functions". Press **OK.**



Press the button to move cursor to indicate the relay control (R1 or R2) whose controls you want to access. Press **OK.**

If the relay reserved for time control has been labeled, R1 (R2) it will indicate what the relay is reserved for (e.g., sauna, outside doors)
Set the time for the relay to be activated and the days of the week for the relay to be activated.
In addition, set the time for the relay to be inactivated and the days of the week for the relay to be inactivated.

Press the **-** or **+** button and confirm the time on the timer by pressing **OK**.

Time program:

The relay can be used to switch an electric apparatus on and off at desired times. When the time program is in the "ON" mode the relay is activated. In this mode the time (time and weekday) is set for the relay to be activated and the time (time and weekday) is set for the relay to be inactivated. Time programming is done in the same way as L1 drop program time programming (see prev. p.). The regulator can be programmed for a maximum of 7 program series (on/off series) per relay.

Continuous ON:

The relay's time program is not in use. The relay is in a forced ON mode (= relay is activated).

Continuous OFF

The relay is in a forced Off mode (= relay is inactivated).

Timer ON

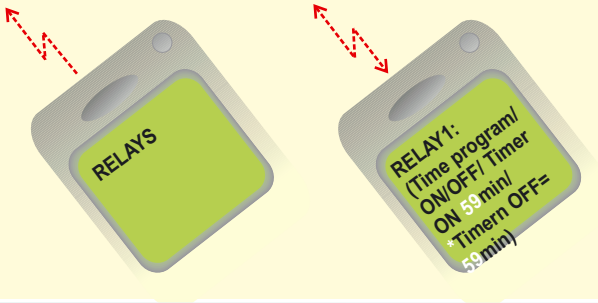
The relay's time program is temporarily replaced by a timer. The relay is in the ON mode (= activated) for a set time (range 0…999min), after which the relay switches to a time programmed mode. Press the or + button to change the time on the timer. The amount of time left on the timer appears on the display.

Timer OFF

The relay's time program is temporarily replaced by a timer. The relay is in the OFF mode (= is inactivated) for a set time (range 0…999min), after which the relay switches to a time programmed mode. Press the or + button to change the time on the timer. The amount of time left on the timer appears on the display.

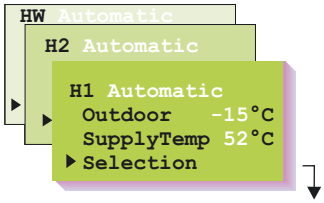
PATENTED GSM CONTROL

KEYWORD:
Relays



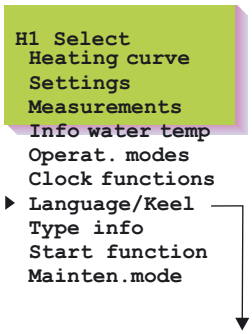
LANGUAGE

The Ouman EH-203 regulator is in two languages. The regulator has the most commonly used languages, Finnish - Swedish, English-Estonian, English-Russian and English-Lett. The language of the regulator can be changed in the following manner.

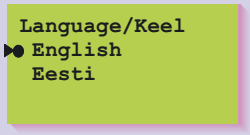


OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.



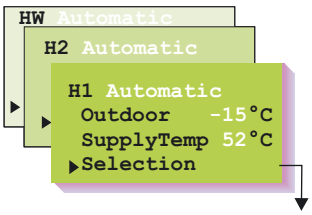
Press the button to move cursor to "Language/ Keel". Press **OK.**



Press the button to move the cursor to the language you want to use. Press **OK.**

TYPE INFORMATION

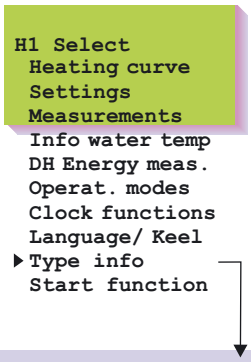
Type information indicates which regulator is in question and which program version is in use. There are two heating circuits and one domestic hot water regulating circuit in the Ouman EH-203 regulator.



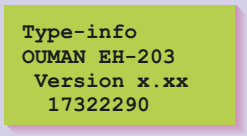
OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.

Press the button to move from one regulating circuit to the next (H1, H2, HW).



Press the button to move cursor to "Type information". Press **OK.**

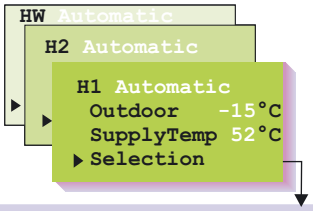


Ouman Finland Oy invests strongly in continuous product development. The version number informs the producer which version is in question.

The serial number is connected to the production process so the manufacturer can determine exactly which regulator is in question.

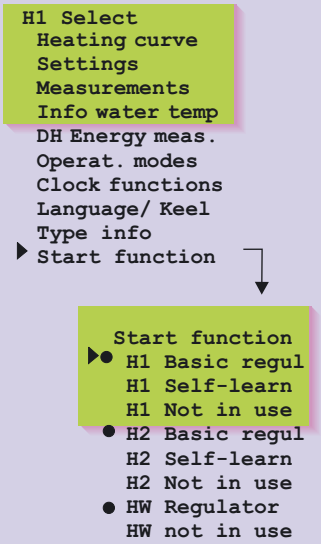
START FUNCTION Regulat. mode sel.

In the start function the regulator detects the sensors that are attached to it. The regulator takes the regulating circuits (H1, H2 and HW) into use according to the supply water sensors. The assumption is that there is a basic regulator in each regulating circuit. It is possible to change the heating regulating circuit (H1 and H2) to a self-learning regulator.
The start function also activates the sensor's fault alarms.
The basic regulator controls the supply water temperature according to the set heating curve.
The self-learning regulator automatically changes the characteristic heating curve according to the feedback from the room sensor. The self-learning maximum adjustment is 10%. The letter **i** on the heating curve display indicates that self-learning is in use.



OPERATING INSTRUCTION:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.



Taking sensors into use and deleting sensors:

If you connect a sensor to the controller or disconnect a sensor from the controller, you must go to start function and then the controller will take sensors into use or delete them.
Press the button to move the cursor to “Start Function”. Press **OK**.
The controller identifies sensors that have been connected and disconnected and displays control modes that can be selected. If you do not want to adjust the control mode, you can press **ESC** to exit from the control mode display without making changes.

The regulator's factory setting is a basic regulator.

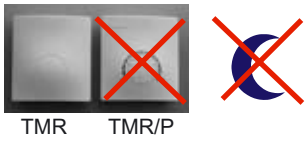
Browsing:

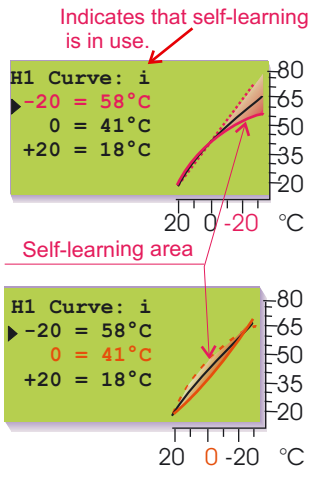
Press the button to browse the possible regulator types in each regulating circuit. Exit with **ESC.**
The ● character indicates which regulator types have been selected from the different regulator circuits.

Changing the regulator type:

Press the button to move the cursor and press **OK.**

SELF-LEARNING INFORMATION:





Self-learning occurs if the room temperature varies at least 1 °C from the set value when the outdoor temperature is in a +5... -5 °C or -15... -25 °C range for at least 4 hours.

Automatic adjustment of the characteristic heating curve occurs at 0 °C or -20 °C. The adjustment rate is 1 °C in 4 hours. The maximum adjustment of the set curve is +/- 10%. If the characteristic heating curve setting is changed, self-learning starts from the beginning.

The room sensor (TMR) has to be in use in order for self-learning to take place. The self-learning setting must not be used if the room compensation unit (TMR/P) is in use. Self-learning does not function during a temperature drop.

Examples of self-learning function:

If the outdoor temperature is between -15... -25 °C, self-learning occurs at the characteristic heating curve's -20 °C setting. For example, if the setting value is 58 °C, the self-learning area is 52... 64 °C (+/- 10% of the set value).
If the outdoor temperature is between -5... +5 °C, self-learning occurs at the characteristic heating curve's -0 °C setting. For example, if the setting value is 41 °C, the self-learning area is 37... 45 °C (+/- 10% of the set value).

ALARMS!

EH-203 gives as alarm when a situation deviates from the norm. In the event of an alarm, the regulator gives an alarm and a message appears on the display. In addition, the alarm relay contact closes. Note! Although the reason of the alarm is no more valid, the last alarm will remain into display intil it is acknowledged. If a GSM modem has been connected to the regulator, the alarm will appear in the desired GSM phone as a text message.

Sensor fault alarms:

```
Alarm!
13/10 11:03
Measurement 1
Outdoor temp err
```

In case of sensor fault, the regulator gives an alarm and a message appears on the display: Alarm! Measurement number and name and err. The alarm relay contact closes (strip connectors 31 and 32).

Deviation alarm:

```
Deviation alarm!
15/5 08:54
Measurement 2
H1 supply 25
```

The regulator gives a deviation alarm if the supply water temp permanently deviates (factory setting 60 min) from the temp set for it by the regulator. (The maximum allowed deviation is listed in special maintenance under "H1 Dev. alarm" settings and the duration of the deviation that causes the alarm to go off is under settings "DevAlaDela", page 29.) Note! H1/H2 deviation alarms do not go off when the pump is on summer stop, the valve is shut for the summer, the controller is in a stand by state or the supply water temperature is just slightly (max.10°C) above the outdoor temperature and the supply water temperature is higher than the set value.

HW overheating alarm:

```
Overheating!
07/03 13:17
Measurement 7
HW supply 78
```

If the HW supply water temperature exceeds the HW alarm limit (factory setting 70 °C), the alarm goes off. The present supply water temperature appears on the display. The alarm relay contact closes (strip connectors 31 and 32). See "Settings", page 23.

Network pressure alarm:

```
Fill alarm!
23/06 13:24
Measurement 6
Netw.press. 0.6
```

If measurement 6 is reserved for measurement of water pressure in the network, the controller gives an alarm if the pressure is too high or too low (fill alarm) and if there is no pressure (lower limit alarm, see p. 31). External alarms can also be connected to EH-203, e.g., a pressure alarm can taken as contact information from the pressure meter giving the alarm. (Alarm labelling is done using the text editor).

Consumption alarm:

```
Consumpt.alarm!
06/1 03:08
Dig 1
```

If pulse information from the facility's water meter is connected to digital inputs, it is possible to monitor possible leaks in the hot water network (see p.32).

Risk of freezing alarm:

```
Risk of Freez!
13/11 13:24
Measurement 6
H1 supply  11
```

The regulator gives a risk of freezing alarm if the supply water temperature goes below the lower limit set for a free drop in the supply water or the lower limit set for the room temperature. The present supply water temperature appears on the display. The alarm relay contact closes (strip connectors 31 and 32). See special maintenance settings page 29.

EXTERNAL ALARMS:

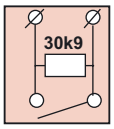
Measurements 6, 9, 10 and 11 as alarms:

"Risk of moisture"

"Wastewater tank"

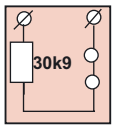
Measurements 6, 9, 10, and 11 can also be used to indicate external alarms (potential free switch). In that case a 30k9 resistor must be connected to the strip connector of the measurement in question.

Closing alarm



When the contact is open "1" appears on the display. When the switch closes, an alarm goes off and the alarm in question appears on the display.

Opening alarm



When the contact is closed "1" appears on the display. When the switch open, an alarm goes off and the alarm in question appears on the display.

Digital inputs as alarms

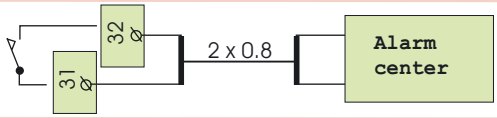
"Thermal relay"

"Water pressure"

The regulator's three digital inputs can be used for receiving alarms. The alarms can be labeled according to topics, e.g., "water damage" (installation p. 32-33). When the contact which is connected to the digital input closes, an alarm goes off and "err" appears on the display. If the alarm is not labeled, "Alarm!, Dig 1(2)(3) will appear on the display. In the event of an alarm, the alarm relay contact closes (strip connectors 31 and 32)

CONNECTING THE ALARM RELAY:

24 VAC/ 1A



ALARM ACKNOWLEDGEMENT:

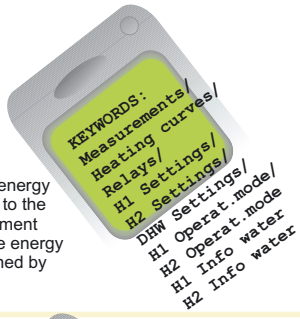
Turn the alarm off by pressing any button. The display will return to the mode it was in before the fault appeared or if there are additional sensor faults their alarm information will appear on the display. If you don't press the keyboard in 20 seconds the alarm will return to the display if the fault has not been corrected.
Note! If a MODBUS 200 is connected, the alarm is acknowledged automatically locally (the alarm will stop sounding, the alarm relay will open and the alarm display will disappear)!

PATENTED GSM CONTROL

The GSM modem (optional equipment) offers an economical "miniature monitor solution". Alarm information is directed to the desired GSM numbers (1 and 2). See p. 37, 38). In the event of an alarm, the regulator first sends a text to GSM1 that indicates the cause of the alarm. The alarm is acknowledged when the same message is sent back to the regulator via the GSM. If the GSM1 does not acknowledge the alarm in 5 minutes, the regulator will send the text message again to both GSM numbers.

GSM- FUNCTIONS

When a GSM modem is connected to EH-203, a GSM telephone can be used to communicate with the regulator via text messages.(installation p. 35). Almost all of the user level functions that are mentioned in this manual can be carried out using a GSM phone. These include measurements, settings, heating curve settings, supply water information and the regulator's operating mode. Clock programs can be bypassed permanently or for certain periods of time. Alarms are also directed to a GSM phone. They can be acknowledged by sending the alarm message back to the regulator.



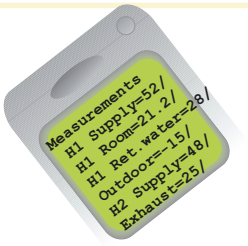
If a district heating energy meter is connected to the controller, measurement information from the energy meter can be obtained by using the key word DH Energy

COMMUNICATING WITH THE REGULATOR USING A GSM:

Send the following text message to the regulator: **KEYWORDS**

If the regulator has a device ID (p. 35,36), always write the device ID before the key word (e.g., TC1 KEYWORDS). The regulator will send a list of key words via text message, which will help you obtain information about how the regulator operates. Each key word is separated by a / character.

Note! The key word DH Energy does not appear when using the key word inquiry.



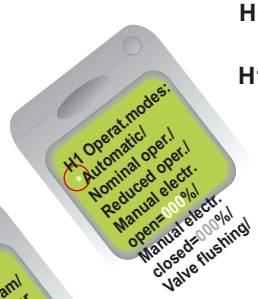
Receiving information from the regulator:

Send a text message to the regulator using key words that it provides you. The regulator recognizes only one request at a time, so write only one key word / message. You can write the key word using capitals or small letters. (If the regulator has a device ID (see p. 35,36), write the device ID in front of the key word.)

The regulator answers your request by sending the desired information.

Operating the regulator using a GSM:

With the GSM phone you can adjust heating curve settings, user level settings, the regulator's operating mode, or time-controlled relay operation. Send the regulator a text message. Using key words, request information about the function whose settings you want to adjust (or obtain the information from your telephone's memory). Adjust the settings in the text message that the regulator sent. Send a text message with the new settings to the regulator. The regulator will make the requested adjustments and acknowledge them by sending back a text message with the new settings.



Keywords:	Instruction for adjusting settings
Heating curves	Write the desired supply water temperature in place of the previous setting in the text message "adjust" mode.
H1 Settings	Write the setting in place of the previous setting
H1 Operat.modes	Put a star (*) in front of the operating mode which you want to start using. When you select manual operating, regulator sends information about the supply water temperature and valve positions (0 - 10V controlled actuators). Attention! When using electric manual control, special caution has to be taken because of danger of freezing and overheating. During the valve flush function, the regulator first opens and then closes the valve. After this automatic regulation continues. The purpose of this function is to clean out a plugged up valve.
Relays	A GSM can be used to control the relay only if the relay is being time controlled. Place a star (*) next to the control mode that you want to begin using. In time control you can also set the length of time it is in effect (range 0…999 min).

Acknowledging alarms:

You can acknowledge an alarm with a GSM by sending the same message back to the regulator.

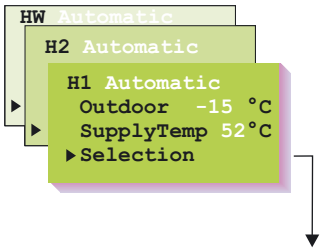
ENTERING THE MAINTEN. MODE

The maintenance person's maintenance guide begins here (p. 21 - 44).

Access to the Ouman EH-203 maintenance mode is prevented by user rights. Only those persons who have a maintenance code have access to the maintenance mode.

There are typical tuning values and settings in the **maintenance mode** which the maintenance person needs in conjunction with installation. An ordinary district heating exchanger is tuned in this mode.

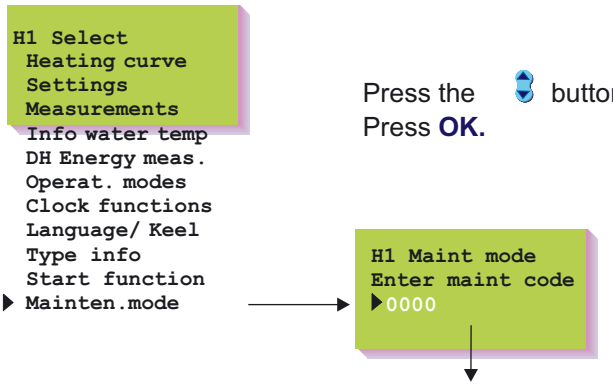
Settings that are not needed as often can be done in the **special maintenance mode**, for ex., restoring original factory settings, special settings, measurement 6 and 9 settings, digital input settings, LON and bus settings as well as modem settings and text message settings.



ENTERING THE MAINTENANCE MODE:

Press **ESC** until the display no longer changes.
You are then in the "Selection" display shown in the adjoining picture.

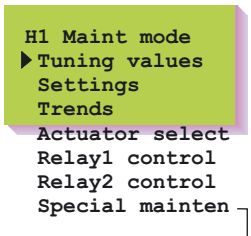
Press the button to move from one regulating circuit to the next (H1, H2, HW).



Press the button to move the cursor to "Mainten. mode".
Press **OK.**

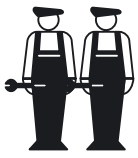
Press **OK.**
Press the **-** or **+** button to set the correct maintenance code one number at a time and press **OK** after each number.

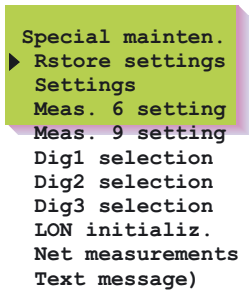
MAINTENANCE MODE:



Press the button to choose what you want to access from the adjoining menu. Each item is presented individually on a separate page.

SPECIAL MAINTENANCE MODE:





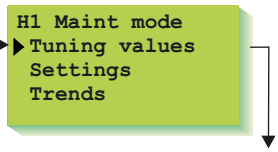
TUNING VALUES

EH 203 has three PID regulators. The tuning values may have to be adjusted, for example, when the district heating exchanger is installed if the setting wavers with the original factory setting.

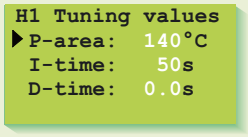
Anticipate and quick run can be set in the HW regulating circuit in addition to PID.

Directions for entering the maintenance mode are on page 21.

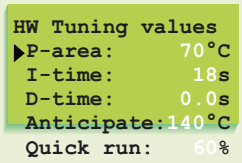
Tuning takes place in the following manner:



The cursor is at "Tuning values". Press **OK.**



Press the button to move the cursor. Press **OK.**
Press the **-** or **+** button to make changes. Press **OK** to confirm.



Press the button to move from one regulating circuit to the next.

INFORMATION ABOUT TUNING VALUES

Settings:	Factory settings:	Range:	Explanation:	Attention!
P-area	H1, H2: 140°C	10...300 °C	Supply water temperature change at which the actuator runs the valve at 100%.	Eg. If the supply water temperature changes 10 °C and the P area is 100 °C the position of the actuator changes 10%.
P-area	HW: 70 °C	10...300 °C		
I-time	H1, H2: 50 s	5...300 s	The deviation in the supply water temperature from the set value is corrected by P amount in I time.	
I-time	HW: 18 s	5...300 s		
D-time	H1, H2: 0.0 s	0.0...10.0 s	Regulation reaction speed up in the event of a temperature change	Beware of constant waver!
D-time	HW: 0.0 s	0.0...10.0 s		
Anticipate	HW: 140 °C	50...250 °C	Uses anticipate sensor measurement information to speed up regulation when HW consumption changes.	Increase the anticipate value to decrease reaction to changes in consumption.
Quick run	HW: 60 %	0...100 %	Functions during consumption changes.	Decrease this value to decrease reaction to quick temperature changes.

The original factory settings may vary from the above. Shorten the I time (to approx. 12 seconds) in the HW 3-way mixer.

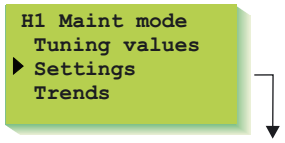
SETTINGS

Ouman EH-203 has three types of settings:

a) **user level settings** which the user can adjust (p. 6-7)
b) **maintenance mode settings** which the maintenance person may have to adjust
c) **special maintenance mode settings** which seldom have to be adjusted (p. 29)

Directions for entering the maintenance mode are on page 21.

The original factory settings are restored in special maintenance (p. 28)



Press the button to move the cursor to "Settings". Press **OK.**

Press the button to move the cursor to the setting whose value you want to change. Press **OK.**
Press the **-** or **+** button to change the setting. Press **OK.**

Press the button to move to the HW regulating circuit

Press the button to move the cursor to the setting whose value you want to change. Press **OK.**
Press the **-** or **+** button to change the setting. Press **OK.**

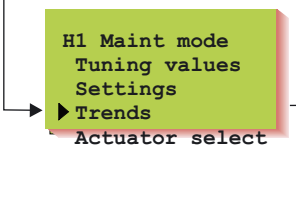
INFORMATION ABOUT MAINTENANCE MODE SETTINGS:

Settings:	Factory settings:	Range:	Explanation:	Attention!
OutdoorDelay	H1: 2 h H2: 0 h	0...20h 0...20h	The length of the outdoor temperature measurement follow-up period from which the regulator calculates the average. Supply water regulation and pump control occur on the basis of the measurement of the average.	
Pre-increase	H1: 0 h H2: 0 h	0...5h 0...5h	The duration of the automatic pre-increase after the reduced operation mode.	
HW alarm	70 °C	65...120°C	Domestic hot water alarm limit.	The alarm limit automatically rises during an increase in HW.
HW increase	0 °C	0...25°C	Domestic hot water increase (anti-bacteria function).	HW **increase time** is set in clock functions (see p. 14).

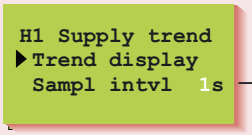
TRENDS

Directions for entering the maintenance mode are on page 21

It is possible to follow supply water temperature changes on the trend display with the graphic depictor. You can decide yourself how often the temperature is measured. The factory set sampling interval is 1 second.

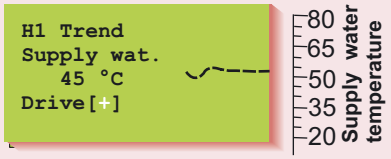


Press the button to move the cursor to “Trends”. Press **OK.**



If you want to see the supply water temperature depictor, press **OK.**

You can read supply water temperature changes graphically.
A supply water temperature scale is printed on the right edge of the display. The exact temperature of the supply water also appears as a numerical value.



If a 3-point actuator is being used, the direction the actuator is being run can be seen on the display. The + character indicates that the actuator is being run into an open position. The - character indicates that the actuator is being run into a closed position.

If a voltage controlled actuator (0...10V or 2...10V) is being used, the actuator's position information can be seen on the display. (0% = closed, 100% = open).

By pressing the group select button, you can inspect other regulating circuit's supply water temperature as a trend display.

Exit with **ESC.**

If you want to change the sampling interval, press the button to move the cursor to "Sampl intvl".
Press **OK.**
The time blinks. Press the **-** or **+** button to set the time.
Press **OK.**

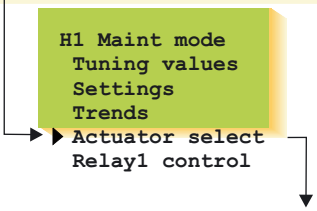
OUMAN®

ACTUATOR SELECTION

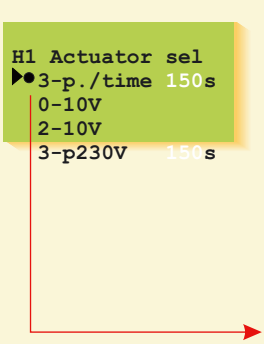
The control mode for each regulating circuit actuator is selected in actuator selection. Options are either 24 VAC 3-point control or DC voltage control (0...10V or 2...10V). If relays 1 and 2 are free, they can be utilized to implement one 230VAC 3-point control. (first choose "230V Actuator" for the relay control mode. See pages 26 and 27)

Regulating circuit H1 actuator's control output is M1.
Regulating circuit H2 actuator's control output is M2.
Regulating circuit HW actuator's control output is M3.

Directions for entering the maintenance mode are on page 21



Press the button to move the cursor to “Actuator select”. Press **OK.**

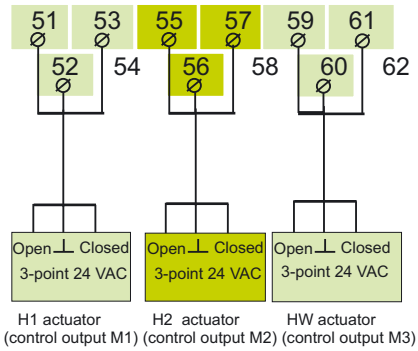


Press the button to move the cursor to the actuator control mode that you want to use. Press **OK.**
3-point control with a driving time of 150 s is a factory setting in H1 and H2 control circuits and 0…10V control with a driving time of 15 s is a factory setting in the DH control circuit. 230V 3-point control can be selected after the relays have first been reserved for 230V actuator control. After you select the actuator control mode the controller requests the actuator driving time. The running time indicates how many seconds go by if the actuator drives a valve nonstop from a closed position to an open position.
Press the **-** or **+** button to set the time. Press **OK.**
The ● character indicates which control mode is being used.

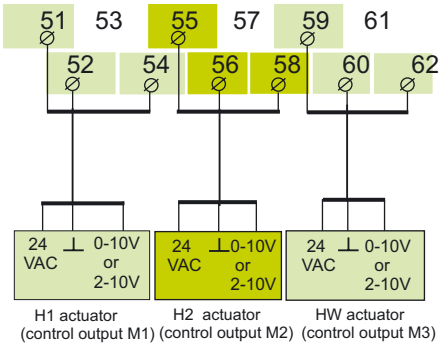
VALVE ACTUATOR CONNECTION:

The button moves you from one regulating circuit to the next.

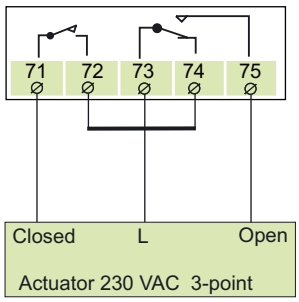
3-point controlled actuator (24VAC)


51 53 55 57 59 61
52 54 56 58 60 62
Open Closed
3-point 24 VAC
H1 actuator (control output M1)
H2 actuator (control output M2)
HW actuator (control output M3)

0...10V or 2...10V DC controlled actuator (24VAC)


51 53 55 57 59 61
52 54 56 58 60 62
24 VAC 0-10V or 2-10V
H1 actuator (control output M1)
H2 actuator (control output M2)
HW actuator (control output M3)

3-point controlled actuator (230 VAC)

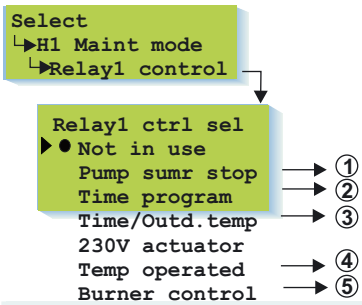


Ouman M31C150

Ouman M41A15

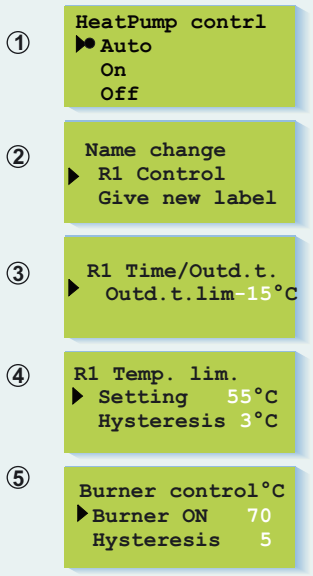
Attention! If "230V actuator" has been selected for relays 1 and 2, one 230VAC 3-point controlled actuator can be connected to the regulator for any regulating circuit (H1, H2 or HW). Selection of relay control modes is shown on pages 26 and 27.

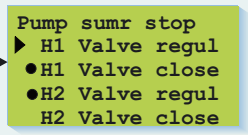
RELAY 1 CONTROL SELECTION



EH-203 has two 230VAC/6A relays. Relay 1 is a break before make contact relay and relay 2 is an on/off relay. The relays can be used for many different purposes. If the relay has been selected for time control use, it can be labeled according to its use using the text editor (e.g., sauna, outside door etc.). Relays are time controlled in the regulator's clock functions (p. 15). The time program can be bypassed with a GSM text message and the relay can be timer controlled or set in a continuous ON or OFF mode.

Press the button to move the cursor to the control mode you want to use. Press **OK.** The ● character indicates which control mode is being used.





Pump summer stop: For each individual regul. circuit, select whether the valve will continue regulat. or whether the valve will close when the pump stops. When you exit from this mode the regul. asks for the outdoor temp. at which the regulator stops the pump. The outdoor temp. limit can also be adjusted in settings, p. 7 pump stop.

Time controlled relay: You can label the relay according to its use. Move the cursor to: Give new label and press **OK.** Use of the text editor is presented on page 8.

Time and temperature controlled relay:
Set the outdoor temperature (when the temp. drops) at which the clock is prevented from effecting relay 1's function. The outdoor temperature limit can also be set in special maintenance settings (see p. 29).

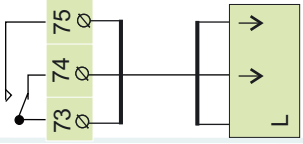
Temperature controlled function:
The factory setting for measurement 11 in temp. cont-rolled functions is 55 °C (setting range 0 ... 100 °C) and the hysteresis is 3°C (setting range 1 ... 10°C).

Burner control: The factory setting at which the burner starts up is 70°C (setting range 5…95°C) and the hysteresis is 3°C (setting range 1…10°C).

ADDITIONAL INFORMATION ABOUT RELAY CONTROLS:

On the display:	Explanation:
Not in use	Relay 1 is not being used.
HeatPump contrl:	
Auto	Select Auto to put summer stop into use. The pumps stop (relay 1's space 73 and 74 opens) and the selected valves close when the outdoor temperature is warmer than the “pump stop” setting. During a stop period the pump/pumps runs(run) for a few minutes every week to prevent them from getting stuck (interval use).
On	Select ON for the pump to run continuously (73-74 closed).
Off	Select OFF for the pump to stop (73-75 closed).
Time program	The regulator time controls any electric apparatus using the relay, e.g., a sauna stove, door locks. Timing programming and control mode selection is done in clock functions (p. 15). In the timing program's "ON" mode the relay is activated. The control mode can also be changed using a GSM telephone (see p. 19-20).
Time/Outd. Temp	The regulator controls relay 1 by time. In the "ON" mode the relay is activated. The "ON" mode is prevented if the outdoor temperature is colder than the relay 1's set outdoor temperature limit. (See p. 29). Timing/ outdoor temperature control is suitable for exhaust fan control. Control → 73 — 75: 1/1 speed ("ON" mode); 74: ½ speed ("OFF"-mode)
230V actuator	When you have reserved relay 1 for 230V actuator control, the regulator automatically also reserves relay 2 for 230V actuator control if relay 2 is free. If relay 2 is not free, the regulator first requests to free relay 2 for 230V actuator control. After this you can begin using 230VAC 3-point control in the "actuator selection" mode (see page 25)
Temp operated	The regulator controls relay 1 according to meas. 11. The relay is active when the temperat. rises to the setting (73-35 closed) and released (73-74 closed) at the end of the set hysteresis (setting - hysteresis). E.g., a cooler's compressor or a fan can be controlled with a temperature controlled relay. The function can be selected when measurement 11 is connected.
Burner control:	The regulator controls the relay according to the boiler water temperature (meas. 10). The relay is activated at the setting (73-75 closed) and the burner starts up. The relay is released (73-74 closed) and the burner shuts off when the boiler water temperature reaches the "setting” + "hysteresis” temperature. The function can be selected when measurement 10 is connected.

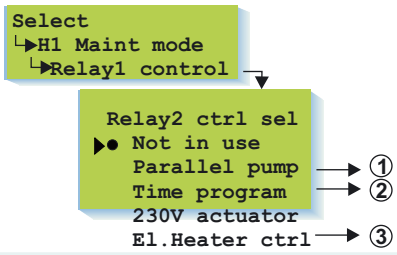
Connection information:



When the relay is inactive (timing program "OFF" mode or no electricity to actuator) the space between contacts 73-74 is closed in the relay.

When the relay is active (timing program "ON” mode) the space between contacts 73-75 is closed in the relay.

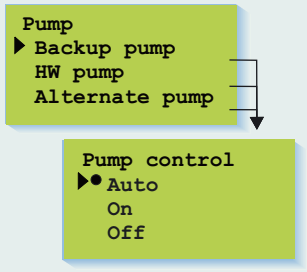
RELAY 2 CONTROL SELECTION



EH-203 has two 230VAC/6A relays for relay controls; relay 1 is a break before make contact relay and relay 2 is an on/off relay.
The following functions can be implemented with relay 2:

1. Parallel circulation pump control
2. Timing control that can be labeled (GSM control compatibility)
3. 230VAC actuator 3-point control (needs both relays)
4. Heating resistor control according to the temperature of meas. 10.

Press the button to move the cursor to “Relay 2 control”. Press **OK.**
Press the button to move the cursor to the control mode that you want to use. Press **OK.**
The ● character indicates which control mode is being used.

① 

Not in use: Relay 2 is not being used.

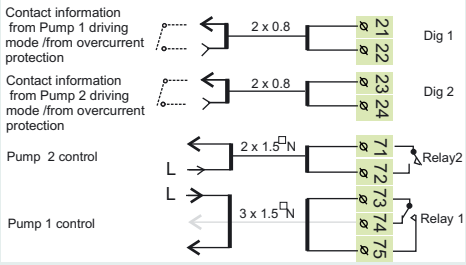
Pump: Select Auto normally for pump control. Select ON and OFF for start-up tests and during maintenance periods. Select ON for the pump to run continuously. Select OFF for the pump to stop.

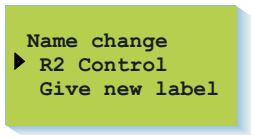
Backup pump/ Auto: If pump 1 stops (over current protection is triggered, see digital inputs p.32) the controller automatically switches on the backup pump (pump 2) and gives an alarm from pump 1. (Pump 2 control occurs via connectors 71 and 72.) Backup pump interval use: The controller switches on the backup pump once a week for a few minutes (Mondays at 9:00-9:05 AM).

HW pump/ Auto: The HW overheating alarm stops the pump.

Alternate pump/ Auto: Pumps 1 and 2 are controlled by the controller to function on alternate weeks as the main pump. The other pump then functions as the backup pump. The pumps are used alternatively so they both get the same amount of wear and thus have a longer lifespan. When one pump is in use the other functions as a backup pump. The changeover is on Mondays at 9.00 AM.

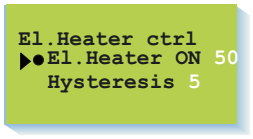
Pump alternation / Back up pump use



② 

Time program:
The regulator time controls any electric apparatus using the relay, ex. a sauna stove, door locks. You can label the relay according to its use (see p.8). Timing programming is done in clock functions (p. 15). In the timing program's "ON" mode the relay is activated. The control mode can also be changed using a GSM telephone (p. 19).

230V actuator:
When you have reserved relay 1 for 230V actuator control, the regulator automatically also reserves relay 2 for 230V actuator control if relay 2 is free. If relay 2 is not free, the regulator first requests to free relay 2 for 230V actuator control. After this you can begin using 230VAC 3-point control in the "actuator selection" mode (see page 23)

③ 

Switching the heating resistor on and off:
Relay 2 switches the heating resistor on and off according to the temperat. of measurement 10. The factory setting at which the heating resistor switches on is 50°C (setting range 5…95°C) and the hysteresis is 5°C (setting range 1…10°C). The regulator uses relay 2 to control the heating resistor according to the temperature of measurement 10. The relay is activated (71-72 closed) and the heating resistor switches on when the temperature drops to the set level. The relay is released (71-72 open) and the heating resistor switches off at the end of the set hysteresis. (setting + hysteresis).

If EH-203 is used for burner control (see p. 26), the regulator can also control the heating resistor according to the same measurement data (meas. 10). There is a separate setting for switching on the heating resistor. The heating resistor can be used as an extra source of heat or the main source of heat depending on whether the setting is higher or lower than the point at which the burner starts up.
Press the **-** or **+** button and press **OK.**

Connection information:

When the relay is inactive (timing program "OFF" mode or no electricity to actuator) the space between contacts 71-72 is open in the relay.

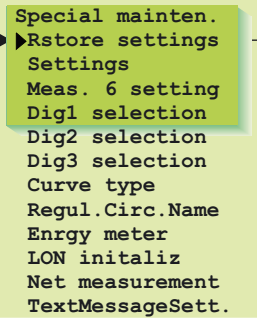
RESTORING SETTING

Restoring settings:

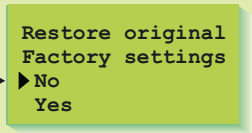
1. The regulator restores factory settings to the charasteristic heating curve settings.
2. Eliminates clock functions
3. Restores user and maintenance level settings
4. Selects automatic control for the operating mode
5. Selects the basic regulator for the regulator type.
6. Identifies the connected sensors and assumes which regulating circuits are in use.
7. Restores factory settings to the tuning values and trend sampling intervals.
8. Selects 0…10V for actuator control with a running time of 150 s in H1 and H2 and the 3-point control for actuator control with a running time of 15 s in the hot water circuit.
9. Relay controls are not in use.
10. Sets alarm Dig 1 (Dig 2, Dig 3) as an assumption into digital inputs.
11. Measurements are not read from the energy meter or bus.
12. Erases the telephone number and restores the factory settings to the modem settings.

Directions for entering the maintenance mode are on page 21.

Original factory settings can be restored with the regulator in the following manner:



Press the button to move the cursor to "Special mainten.".
Press **OK.**
The cursor is at "Rstore settings". Press **OK.**

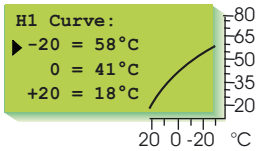


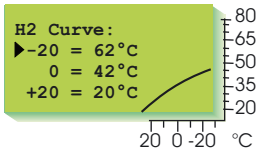
Restore original factory settings:

Press the button to move the cursor to "Yes".
Press **OK.**

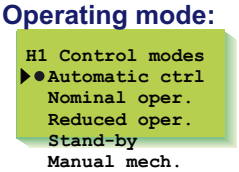
ORIGINAL FACTORY SETTINGS:

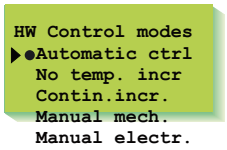
Characteristic heating curve:



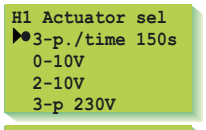


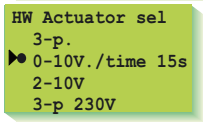
Operating mode:





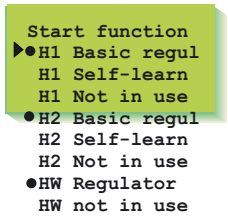
Actuator selection:





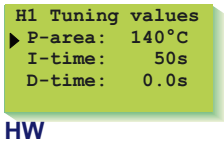
User level settings:	Factory setting:
Room temperature	21.5 °C
Temperature drop (supply water)	0 °C
Min. allowed supply water	15 °C
Max. allowed supply water	70 °C
Parallel shift	0 °C
Room compensation ratio	4.0 °C
Wind compensation ratio	0 °C
Sun compensation ratio	0 °C
Pre-increase	0 °C
Autumn drying	2 °C
Burner ON	70°
El.Heater ON	50°
Valve close	19 °C
Relay 1 temperature limit	55°C
Domestic hot water	55.0°C
Maintenance level settings:	
Outdoor temp. delay H1/ H2	2 h/ 0 h
Pre-increase H1/ H2	0 h/ 0 h
Domestic hot water alarm	70 °C
Domestic hot water increase	0 °C
Special maintenance settings:	
Room temperature delay	0.5h
Return water maximum H1	70°C
Return water min. at 0°C	5°C
Return water min at -20 °C	15°C
H1 Supply water min at 0°C	10°C
H2 Supply water min at 0°C	10°C
H1 Supply water min at -20°C	30°C
H2 Supply water min at -20°C	30°C
The amount of deviation from the setting, which causes the alarm H1/H2/HW/R1	75°C
The duration of the deviation that causes the alarm	60min
Output limit	999kW
Water flow limiting function	99.9l/s
½ exhaust	6°C
Domestic hot water alarm delay	120s
Relay 1 outdoor temperature limit	-15°C

Start function:

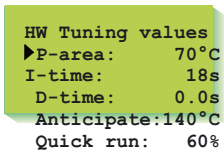


Tuning values:

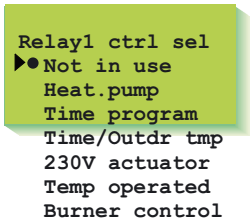
H1, H2

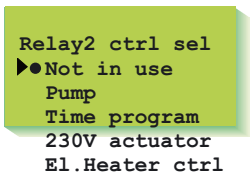


HW



Relays:

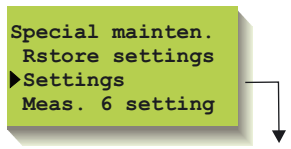




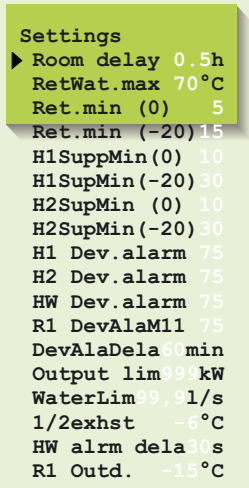
SETTINGS

In the Ouman EH-203 heating regulator the user can adjust most of the settings (see settings p. 6-7). Some of the settings that control the regulator's functions can be set in the maintenance mode (see page 23) and some in special maintenance. Seldom needed settings can be adjusted in special maintenance.

Directions for entering the maintenance mode are on page 21.



Press the button to move the cursor to "Settings". Press **OK.**



Press the button to move the cursor to the parameter that you want to change. Press **OK.**

Press the **-** or **+** button to change the setting. Press **OK.**

INFORMATION ABOUT SPECIAL MAINTENANCE SETTINGS:

Settings:	Factory settings:	Range:	Explanation:	Attention!
Room delay	0.5h	0...2	The average inside temperature measurement time which the room compensation uses.	
RetWat. max	70°C	25...95	Return water maximum allowed temperature at which the regulator begins lowering the return water temp.	Only L1
Ret.min (0°C)	5°C	5...20	Freeze protect limit. Minimum return water temperature when the outdoor temperature is 0°C.	Only L1
Ret.min(-20°C)	15°C	10...50	Freeze protect limit. Minimum return water temperature when the outdoor temperature is -20°C.	Only L1
H1 SuppMin (0°C) H2 SuppMin (0°C)	10°C 10°C	5...20 5...20	Lower limit of supply water during a free temperature drop in the regulating circuits H1/H2 when the outdoor temperature is 0°C. (stand-by function)	
H1 SupMin(-20°C) H2 SupMin(-20°C)	30°C 30°C	10...50 10...50	Lower limit of supply water during a free temperature drop in the regulating circuits H1/H2 when the outdoor temperature is -20°C. (stand-by function)	
H1 Dev. alarm H2 Dev. alarm HW Dev. alarm R1 DevAlaM11	75°C 75°C 75°C 75°C	1...75 1...75 1...75 1...75	H1/H2/HW supply water temperature deviation from the setting determined by the regulator which causes the alarm Temp. (meas. 11) deviation from the setting of "R1 Temp operated" which causes the alarm. This setting appears if "Temp operated" has been selected in the relay1 control mode (see page 26).	
DevAlaDela	60 min	0...90	The alarm goes off if the deviation has lasted for the set time.	
Output lim	999 kW	0...999	Maximum district heating water flow at which output limiting begins in regulating circuit H1	Only L1
WaterLim	99.9 l/s	0.1...99.9	Maximum district heating output at which output limiting begins in regulating circuit H1.	Only L1
½ exhst	-6°C	0...-10	Drop in supply water temperature when the exhaust fan is at ½ speed (see page 32).	Only L1
HW alrm dela	30s	0...30	The length of time from which the regulator calculates the HW average temperature for the alarm.	
R1 Outd.	-15°C	-30...+20	The outdoor temperature limit for relay 1 (in use when time /outdoor temperature control has been selected for relay 1's control mode)	

MEASUREMENT 6 SETTING

Measurement 6 can be used as a free temperature measurement, Room temperature measurement, wind measurement or measurement of the pressure in the heating or ventilation network. It is factory set as a free temperature measurement labelled “Cold water”. The label for Measurement 6 can be changed using the text editor.

0…10V transmitters are used in wind-/pressure measurements. In this mode you can set the wind transmitter area that wind compensation occurs at. The wind compensation temperature amount is set in Settings (see p.6). A pressure transmitter can be used to set alarm limits for upper limit, fill, and lower limit alarms.

Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
▶Meas. 6 setting
 Dig1 selection
```

Press the ▲▼ button to move the cursor to "Meas. 6 setting". Press **OK.**

```
 Meas. 6 setting
▶● Cold water
   H2 Room temp
   Wind meas.
   Sun meas.
   Not connected
```

Selecting measurement 6:

Press the ▲▼ button to move the cursor to what you want to connect to measurement 6. Press **OK.**

The ● character indicates which measurement has been chosen for measurement 6.

Labeling measurement 6 using the text editor:

```
 Name change
▶Cold water
 Give new label
```

The factory setting for measurement 6 is "Cold water" Relabeling is shown on page 8.

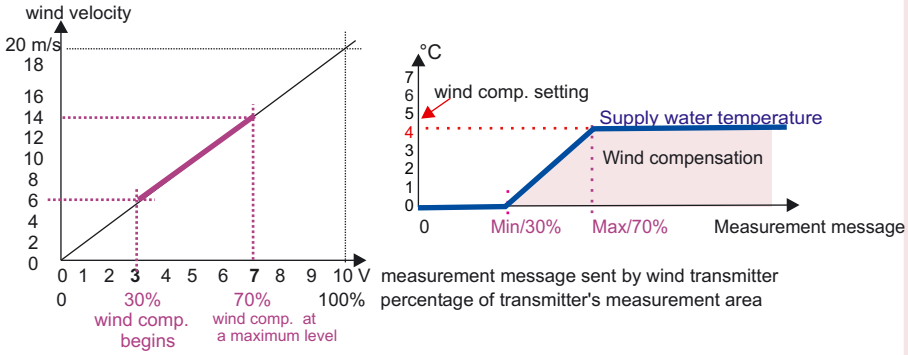
Setting limits for the wind sensor measurement message:

Setting the limit for the wind sensor measurement message. You must set compensation area limits in volts. The minimum limit indicates where in the emitter's measurement area compensation begins and the maximum indicates at which measurement area the compensation is at a maximum level. (To set the amount of compensation see p. 6)

```
Comp/Meas. data
▶Min /   0%
 Max / 100%
```

Press **OK.**
Press the **-** or **+** button to set a limit and press **OK** to confirm.

E.g., the effect of wind compensation on supply water
A wind sensor is in use which has a measurement area of 0… 20m/s. You want wind compensation to begin when the wind velocity is 6 m/s and compensation to be at maximum value when the wind velocity is 14 m/s. Wind compensation is set at 4°C (setting range -7 …7°C).

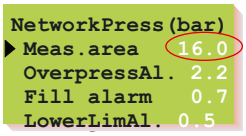


The wind transmitter is connected in the same way as the pressure transmitter using a voltage divider resistor (see next page, connection 1)

Network pressure:

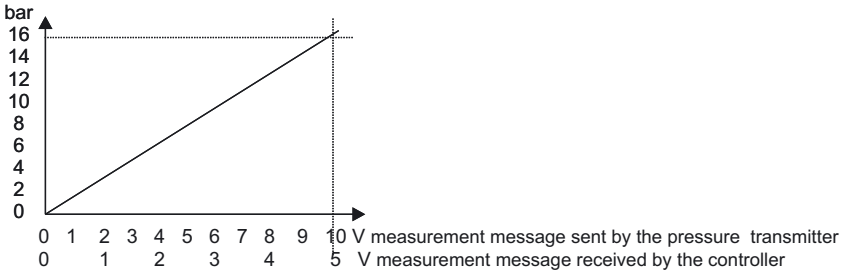
See the next page for instructions on setting the measurement area for the network pressure and setting pressure alarms.

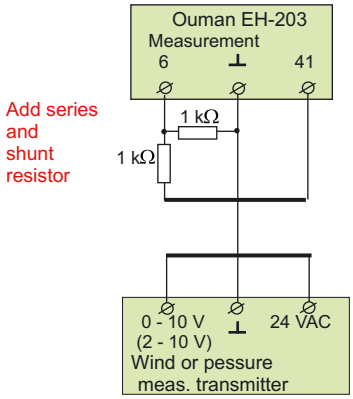
Network pressure:

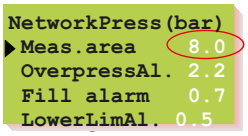


Connection 1. Connect the pressure sensor using a resistor

The controller's measurement channel 6 can have a 10V emitter voltage but can only measure 0…5V. If you want to use the entire measurement area of a 0…10V emitter (e.g., 0…16 bar), make the connection using a voltage divider resistor. The measurement area is then the emitter's measurement area, e.g., 16 bar.

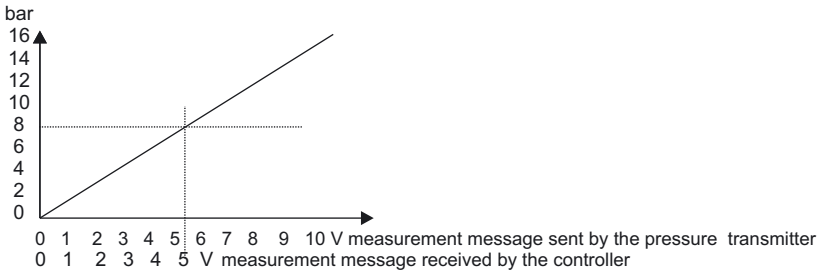


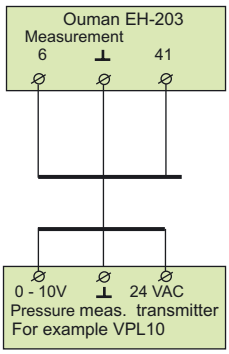


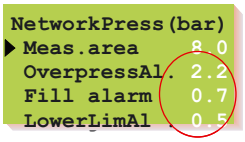


Connection 2. Connect the pressure sensor without resistor

If the pressure in the network never exceeds 50% of the emitter's measurement area, the emitter can be connected directly to the controller without voltage divider resistors. Set the measurement area at one half of the emitters actual measurement area (e.g., 8.0 bar for a 0… 16 bar emitter). Without voltage divider resistors the controller only recognizes one half (0…5V) of the emitter's measurement message (0…10V).







Produal VPL10
pressure transmitter

Set alarm limits for overpressure, fill, and lower limit alarms

Overpressure alarms: The controller gives an alarm when the pressure in the network exceeds the “Upper Limit Alarm” setting. The factory setting is 2.2 bar. Typical reasons for upper limit alarms include; excessive filling of the network, warning valve dysfunction or expansion tank breakage. Drain excessive water from the network. Inspect the condition of the warning valve and expansion tank if the alarm was not caused by overfilling.

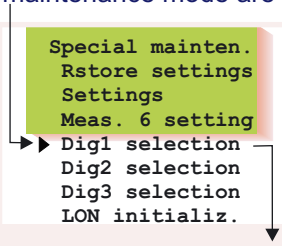
Fill alarm: The controller gives an alarm when the pressure in the network drops below the “FillAlarm” setting. The factory setting is 0.7 bar. The fill alarm warns of underpressure in the network. In the event of an alarm, check if any leaks can be seen. Fill the system to its normal pressure. Check out the situation. If the fill alarm goes off frequently, check the condition of the expansion tank and inspect it for possible leaks.

Lower limit alarm: The controller gives an alarm when the pressure in the network drops below the “Lower limit alarm” setting. The factory setting is 0.5 bar. The lower limit alarm is a critical warning of a too low pressure in the network. Look for possible leaks. Inspect the condition of the expansion tank. If the fill alarm and lower limit alarm occur in succession within a short time period it is usually an indication of a leak in the network.

DIGITAL INPUTS 1, 2, 3

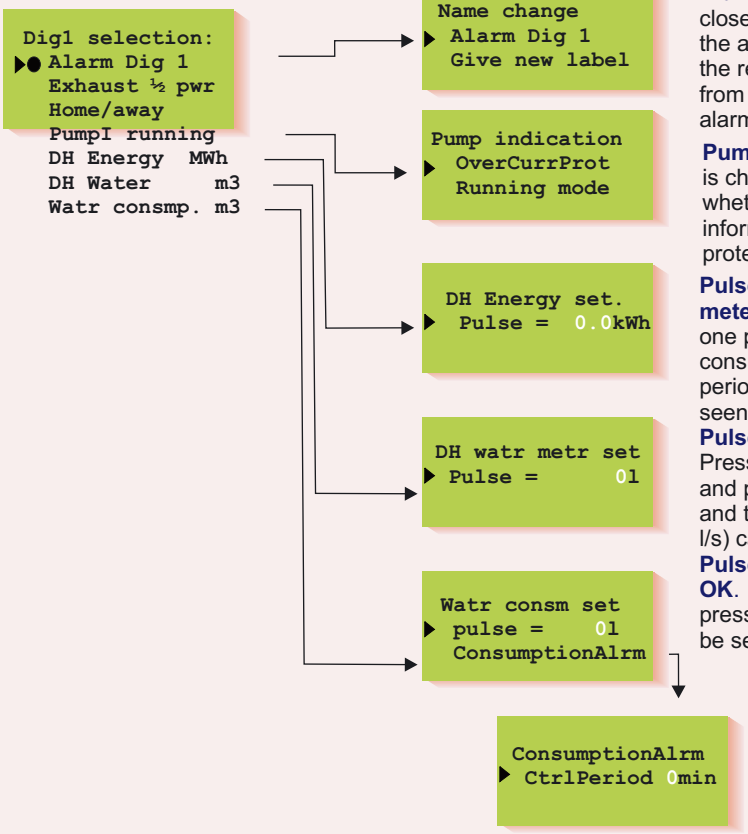
EH-203 has three digital inputs. A digital input can be connected to contact information or pulse information. Contact information can be used to receive an alarm, e.g., blower overcurrent protection alarm. Alarms can be labelled using the text editor according to their cause. Alarms can be transferred to, e.g., A GSM phone as text messages. Pulse information can be read, e.g., from a district heating energy meter or water meter.

Directions for entering the maintenance mode are on page 21.



Press the ▲▼ button to move the cursor to"Dig 1, Dig 2 or Dig 3 selection".
Press **OK.**

Press the ▲▼ button to move the cursor to indicate which information has been connected to the Dig channel in question. Press **OK.**
The ● character indicates the selection made.



Alarm use: Alarm switch information. When the switch is closed, an alarm goes off. You can use the text editor to label the alarm, e.g., Order oil! (see p. 8). In the event of an alarm, the regulator sounds the alarm and indicates on the display from which digital input the alarm came from. Transferring the alarm to a GSM phone (see p. 36, 37).

Pump1(2) running indication: The purpose of this function is check that the pump is in operating condition. Select whether to inspect pump running from running mode information or from information received from overflow protection.

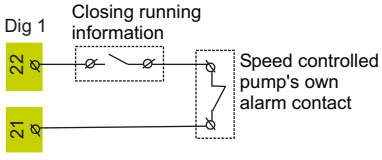
Pulse information from the district heating energy meter: Press **OK**. Set the number of kWh equivalent to one pulse and press **OK**. District heating energy consumption (MWh) and the momentary (5 min. follow-up period) district heating power consumption (kW) can be seen on the regulator's measurements display.

Pulse information from the district heating water meter: Press **OK**. Set the number of liters equivalent to one pulse and press **OK**. District heating water consumption (DH m3) and the momentary district heating water consumption (Inst. l/s) can be seen on the regulator's measurements display.

Pulse information from the facility's water meter: Press **OK**. Set the number of liters equivalent to one pulse and press **OK**. The facility's water consumption (Water m3) can be seen on the regulator's measurements display.

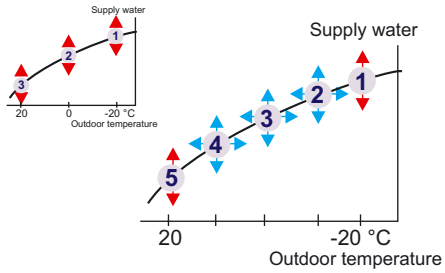
Inspection of hot water network for leaks: Press **OK.** Set the length of the control period. Press **OK.** If in a 24 hour period there is no time period with no consumption for the length of the control period the controller gives a consumption alarm indicating continuous hot water consumption. With the setting at 0 (factory setting) the function is not in use. The setting range is 0…99 minutes.

On the display:	Explanation:
Exhaust ½pwr	Exhaust fan ½ speed information. When the switch is closed the exhaust fan is at ½ speed. The information is used to lower the heat when the exhaust fan is at ½ speed. The amount of the drop is given in special maintenance settings. (see p. 27, ½ exhst)
Home/away	Away switch information. (switch closed, H1/H2 reduced temperature mode is on).
Pump 1(2) running:	**Overcurrent protection:** In speed controlled pumps, pump indication is taken from alarm contacts or from a separate overcurrent protection in the input current circuit. In the event of an alarm the contact closes. If the alarm is given when the alarm contact closes, the alarm is acknowledged from a separate switch. The alarm may stop sounding after a power failure. Contact information for constant speed pumps is taken from the pump's temperature relay. When the contact is closed the pump does not run. The controller then gives an alarm and starts up the other pump (if the alternate pump is in use). **Running mode:** Pump running mode information is taken from a separate potential free closing contact in the input current circuit. (The pump runs when the contact is closed). Speed controlled pumps usually do not have their own running information contact. If a speed controlled pump is controlled by cutting the supply voltage (not recommended) the pump's own alarm contact can be connected as an opening contact to the input current circuit as a series with the potential free contact. (see diagram to the right). Compare the running information and control. If control and running information are not in the same mode the controller gives a contradiction alarm if the contradicting situation has lasted for 10s. In a contradicting situation the controller keeps controlling the pump. When the contradiction ends the alarm is turned off.
ConsumptAlarm	If in a 24 hour period there is no pulseless time period of the length of the control period, the controller gives a leakage alarm. The alarm is acknowledged locally from the controller. The alarm can also be automatically acknowledged if there is a pulseles control period during the next 24 hour period. This function can be used to discern moderate sized leaks, e.g., a leaking toilet.



OUMAN EH-203

CHARACTERISTIC HEATING CURVE TYPE SELECTION



Selection of a three point or five point heating curve. A 3-point curve is a factory setting.
'3-point curve: You can adjust the heating curve with outdoor temperature values 20°C, 0°C and +20°C. EH-203 prevents you from making a heating curve of the wrong shape. It automatically proposes a correction. If a 3-point curve has been selected it is possible to take self-learning into use (see p. 17), and the controller will automatically adjust the heating curve according to feedback from the room sensor.
5-point curve: You can adjust the heating curve with outdoor temperature values - 20°C and +20°C and with three additional outdoor temperatures between -20°C - +20°C. **Note! The automatic proposed correction and self-learning are not in use!**

Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
 Meas. 6 setting
 Dig1 selection
 Dig2 selection
 Dig3 selection
▶Curve type
 Regul.Circ.Name
 LON initializ.
```

Press the ▲▼ button to move the cursor to ”Curve type”.
Press **OK.**

```
Curve type
▶● 3-point
   5-point
```

Select a 3-point curve or 5-point curve and press **OK**.
The ● character indicates the selection made. Set heating curves are displayed and can be adjusted in “Heating curve”, see p. 4.

OUMAN EH-203

LABELLING CONTROL CIRCUITS

Hint !

Label the control circuit according to its target area. E.g., floor heating or preheating for air conditioning.

After labelling control circuits, the top row of the controller's basic display will alternately display the control mode and name of the control circuit.

```
H1 Automatic
 Outdoor-15°C
 SupplyTemp52°C
▶Selection
```

↔

```
H1 Radiator netw
 Outdoor-15°C
 SupplyTemp52°C
▶Selection
```

Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
 Meas. 6 setting
 Dig1 selection
 Dig2 selection
 Dig3 selection
 Curve type
▶Regul.Circ.Name
 LON initializ.
```

Press the ▲▼ button to move the cursor to ”Regul.Circ.Name”.
Press **OK.**

```
Regul.Circ.Name
▶H1:
 H2:
```

Move the cursor to the control circuit (H1,H2), that you want to label.
Press **OK.**

```
Name change
▶H1:
 Give new label
```

Press the ▲▼ button to move the cursor to "Give new label”.
Press **OK**. "-” blinks. Write the name using the text editor. You can move forward or backward in the character row with the **-** or**+** button.
Confirm the number by pressing **OK**, then the same number that you selected will blink in the next space. Whichever has been selected last can be deleted by pressing **ESC**. If you press the **ESC** button for a while, the number will be deleted and the number that was previously fed will remain in effect. When you are ready, press **OK** for a while (over 2 secretary.).

```
▶Name change
  H1:
  _
```

ENERGY METER

Take into use:
1. District heating energy consumption reading from an energy meter (see p. 11).
2. Automatic reporting from an energy meter by text message. If using automatic reporting, set the day when the report is to be sent and the GSM numbers that the report is sent to. The controller automatically sends a monthly consumption report by text message from the energy meter to two selected GSM numbers.

Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
 Meas. 6 setting
 Dig1 selection
 Dig2 selection
 Dig3 selection
 Curve type
 Regul.Circ.Name
▶ Enrgy meter
 LON initaliz
```

Press the button to move the cursor to "Energy meter"".
Press **OK.**

```
Energy meter
▶● Not connected
   Connected
```

Taking automatic reporting into use:
Press the button to move cursor to “Connected”. Press **OK**.

```
  Report
▶● Report day 0
   Report tel.no1
   Report tel.no2
```

A report is not sent when the set value is 0. Otherwise the report is sent on a set day. If there are fewer days in the month than the set reporting day, the report is sent on the last day of that month.

```
Telephone nr.

▶ Change
```

Write the GSM number that the controller sends the report to from the energy meter as a text message. the number is given with the text editor as follows:
Press the button to move the cursor to "Change”. Press **OK**. "O” blinks.
Write the telephone number using the text editor. You can move forward or backward in the character row with the **+** or **-** button. Confirm the number by pressing **OK**, then the same number that you selected will blink in the next space. Whichever has been selected last can be deleted by pressing **ESC**. If you press the **ESC** button for a while, the number will be deleted and the number that was previously fed will remain in effect. When you are ready, press **OK** for a while (over 2 secretary).

Installation of EMR-200, Energy meter read head to the energy meter:

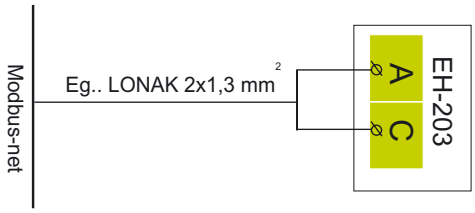
- Attach the magnetic surface of the EMR-200 to the energy meter so that the connecting cord goes down.
- The Kamstrup Multical energy meter has control knobs for positioning the EMR-200. Install the EMR-200 energy meter so that it touches the knobs on the bottom and side.
- The EVL energy meters has a metal ring for attaching and positioning the EMR-200.
- The EMR-200 has a 10 m connection cord- A 10 m extension cord (CE-EMR10) can be used if necessary

BUS CONNECTIONS/ LON initialization

The Ouman EH-203 controller can be connected to the MODBUS, RS-485 or LON bus. When the EH-203 controller is connected to the bus, a (Modbus-200, EH-485, or LON-200 card) bus adapter card (optional equipment) is installed. Detailed instructions for installing and initializing the bus adapter card are provided.

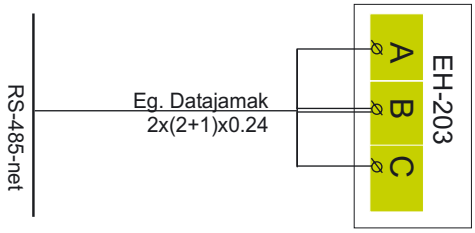
When connecting the controller to the LON-field bus, LON-bus initialization occurs in the controller's special maintenance mode. Other buses do not have to be initialized from the controller.

Connect the EH-203 to a MODBUS field bus:



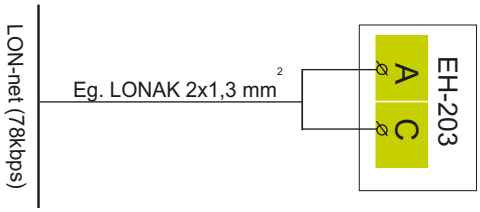
MODBUS-200-adapter card

Connect the EH-203 to a RS-485 field bus:

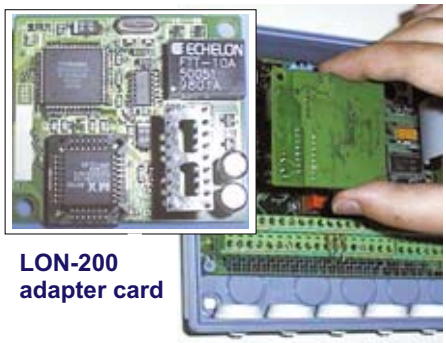


EH-485-adapter card

Connect the EH-203 to a LON field bus:

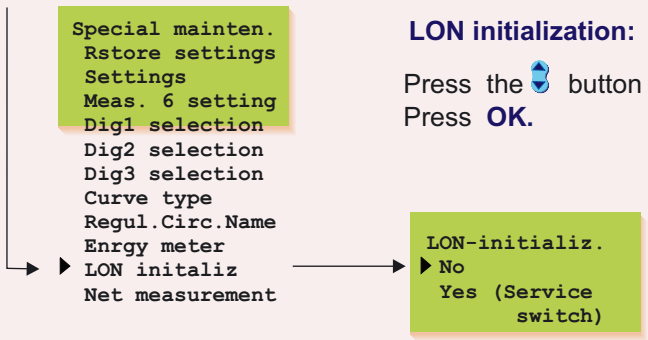


When using an LON bus connect the protective ground of the 230VAC supply current to strip connector 81 of the controller!



LON-200 adapter card

Directions for entering the maintenance mode are on page 21.



LON initialization:

Press the button to move the cursor to"LON initializ.".
Press **OK.**

In this special maintenance mode you can control the Neuron processor's service pin which is on the LON-200 card so that the Neuron sends the bus its own identification (48 bit Neuron ID). This procedure is necessary when initializing EH-203 + LON-200 into the facility's LON net .

NET MEASUREMENT

Ouman EH-203 has an LON-200, RS-485 and MODBUS-200 bus adapter cards as an optional equipment.
In this special maintenance mode you can select which measurement informati is to be read from the net.
If you selected to read wind or sun measurements from the net, you must set the compensation area in this mode.

Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
 Meas. 6 setting
 Dig1 selection
 Dig2 selection
 Dig3 selection
 Curve type
 Regul.Circ.Name
 Enrgy meter
 LON initaliz
▶Net measurement
 TextMessageSett.
```

Press the ▲▼ button to move the cursor to"Net measurement".
Press **OK.**

```
 Net measurement
▶● Outdr tmp meas
   H1 Room meas.
   H2 Room meas.
 ● Wind measure
 ● Sun measure
   DH Energy MWh
   Watr consm. m3
```

Browsing the net measurements:

By using the ▲▼ button to browse, you can see which measurements can be read from the net.

Setting net measurements:

```
Outdr tmp meas
▶● No net
   Yes net
```

Move the cursor to the measurement you want and press **OK.**
If you want to select an serial interface for the measurement in question, move the cursor to Yes net and press **OK.** The ● character indicates that the measurement information is read from the net.

Setting wind or sun measurements (net):

You must set the compensation limits for wind and sun measurements. The minimum indicates when compensation begins and the maximum indicates when compensation is at a maximum value. Set the limits for wind measurement as wind speed (m/s) and for sun measurement as amount of light (lx).

```
Comp/Meas. data
▶Min/     0.0m/s
 Max/    10.0m/s
```

```
Comp/ Meas. data
▶Min/        0 lx
 Max/     9000 lx
```

Setting limits:
Press **OK.**
Press the **-** or **+** button to set the limit and confirm by pressing **OK.**

Attention! Set wind and sun compensation in "Settings" (see page 6-7).

MODEM SETTING (TEXT MESSAGE CONNECTION)

Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
 Meas. 6 setting
 Dig1 selection
 Dig2 selection
 Dig3 selection
 Curve type
 Regul.Circ.Name
 Enrgy meter
 LON initaliz
 Net measurement
 TextMessageSett.
```

In order to communicate via text messages, the controller must be connected to a GSM modem (optional equipment). The modem comes with an adapter cable equipped with D-connector that is used to connect the Modem to the controller. The controller's strip connector B-D space is connected with a jumper wire.

GSM modem connection is done in start functions. The controller automatically initializes the GSM modem in two hour intervals. This prevents the GSM from becoming disconnected in the event of a power failure.

```
TextMessageSett.
 Alarm GSM1 nr
 Alarm GSM2 nr
 Device ID
 MessageCentreNr
 PIN-code
 Modem type
```

Installing receivers for alarm messages:

Give a telephone number that the regulator automatically sends a text message to about an alarm in the event of an alarm. At first the alarm message is only sent to the GSM number 1. If the alarm is not acknowledged from this number, after five minutes the regulator sends a new alarm to both the GSM 1 and 2 numbers.

```
Telephone nr.
 Change
```

Press the button to move the cursor to "Change". Press **OK**. "O" blinks. Write the telephone number using the text editor. You can move forward or backward in the character row with the **+** or **-** button. Confirm the number by pressing **OK**, then the same number that you selected will blink in the next space. Whichever has been selected last can be deleted by pressing **ESC**. If you press the **ESC** button for a while, the number will be deleted and the number that was previously fed will remain in effect. When you are ready, press **OK** for a while (over 2 secretary.).

Device ID:

The regulator can be given a device ID, which functions as the device's secret password and address information. The device ID can be freely labeled. The device ID is always written in front of the key word when using the GSM to communicate with the regulator.

```
Device ID
 Not in use
 In use   0000
```

Move the cursor to "In use". Press **OK**. "0" blinks. Write a device ID that has a max. of 4 characters. The text editor has the letters A…Z and the numbers 0…9. You can move forward or backward in the character row by pressing the **+** or **-** button. Confirm the character by pressing **OK**.

```
Telephone nr.

 Change
```

Installing the number for the message center:

Give the operator-specific message center number with **+** or **-** button. Confirm by pressing **OK**.

```
PIN-code
 ----
 Change
```

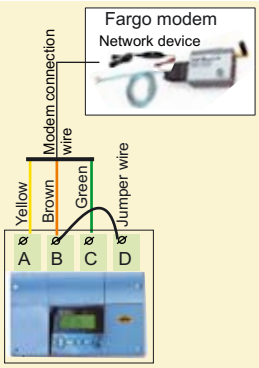
Installing the modem's PIN for the regulator:

Give the SIM card's PIN code. The regulator will not initialize the GSM modem before the PIN code is installed. The SIM card has to be put in the GSM telephone to change the modem's PIN code. When you have changed the PIN code, install the SIM card back in the modem.

```
Modem type
 Falcom
 Nokia/Siemens
 Ouman/Fargo
```

Selecting the modem type:

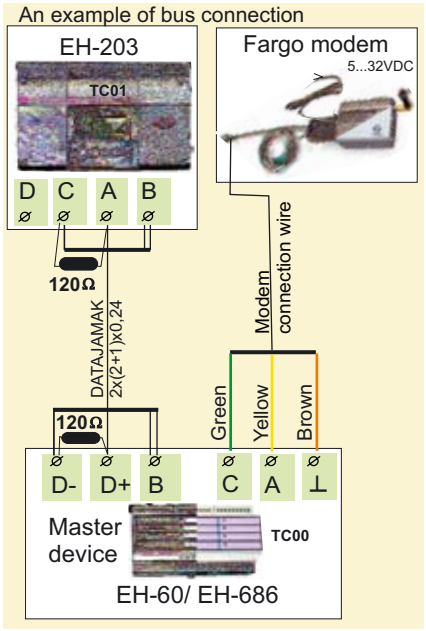
EH-203 is compatible with Falcom A2D, Nokia 30,Siemens M20T and Fargo Maestro 20 and 100 Lite modems.



Guide for Fargo Maestro20 modem connection and initialization:

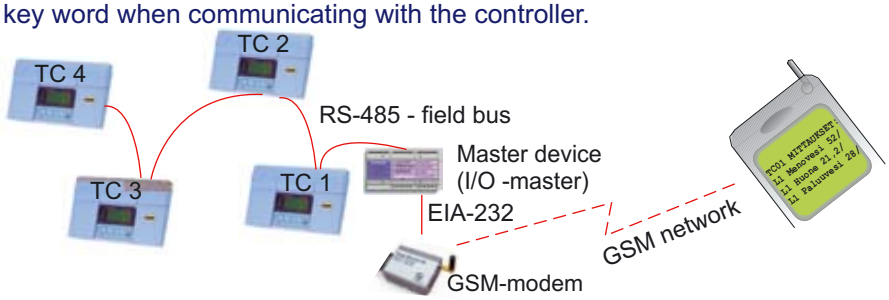
LED indicator light	Modem mode/ instructions
LED is not on:	The modem is not on. Connect the modem to the network device.
LED is on:	The power is on but the modem is not ready to use. Inspect the following: 1. EH-203 has the same PIN code as the GSM modem's SIM card PIN code. 2. Perform the start-up function. To start-up, move to Start function. Press OK. Exit with ESC without changing settings.
LED blinks slowly:	The modem is ready to use.
LED blinks rapidly:	The modem sends or receives messages. If a message does not come from the controller, check the text message you have sent to see that the device ID and keyword have been written correctly. Also check that the EH-203 controller has the operator's message centre number of the GSM connection you have in use. The factory setting is a Saunalahti connection.

TEXT MESSAGE SETTINGS (NET SOLUTION)



That which is presented on this page is in effect when a modem has not been directly connected to the controller. Communication occurs through the controller's RS-485 field bus. Many controllers can be connected to the system by using the EH-485 bus adapter card and a modem can be connected to the RS-485 field bus through the master device, EH-686.

An EH-485 bus adapter card must be installed in the controller so that the EH-203 controller can be connected to the RS-485 field bus. (see installation and initialization guide in the instructions that come with the EH-485 card). Controllers that are connected to the bus are given a device ID (e.g., TC 1) so the system can identify which controller is being communicated with. The device ID always has to be written in front of the key word when communicating with the controller.



Directions for entering the maintenance mode are on page 21.

```
Special mainten.
 Rstore settings
 Settings
 Meas. 6 setting
 Meas. 9 setting
 Dig1 selection
 Dig2 selection
 Dig3 selection
 Curve type
 Regul.Circ.Name
 Enrgy meter
 LON initaliz
 Net measurement
▶TextMessageSett.
```

```
TextMessageSett.
▶Alarm GSM1 nr
 Alarm GSM2 nr
 Device ID
```

Press the ▼ button to move the cursor to "Text message".
Press **OK.**

Installing receivers for alarm messages:

A GSM telephone can receive alarms and also acknowledge them. A telephone number is given here that the regulator automatically sends a text message to about an alarm in the event of an alarm.
At first the alarm message is only sent to GSM number 1. If the alarm is not acknowledged from this number, after five minutes the regulator sends a new alarm to both GSM numbers 1 and 2

```
Telephone nr.
▶Change
```

Press the ▼ button to move the cursor to "Change".
Press **OK**. "O" blinks.
Write the telephone number using the text editor.
You can move forward or backward in the character row with the **+** or **-** button. Confirm the number by pressing **OK**, then the same number that you selected will blink in the next space. Whichever has been selected last can be deleted by pressing **ESC**. If you press the **ESC** button for a while, the number will be deleted and the number that was previously fed will remain in effect. When you are ready, press **OK** for a while (over 2 secretary.).

Installing the device ID:

When an RS-485 field bus is used for text message connections, the regulators are identified using a device ID. The device ID which is 4 characters long and can be freely labeled using the text editor functions as address information. The device ID is given as follows.

```
Device ID
▶ Not in use
  In use    ----
```

Move the cursor to "In use". Press **OK**. "0" blinks.
Write a device ID that has a max. of 4 characters by pressing the **+** or **-** button. Confirm the character by pressing **OK**.

Guide for Fargo Maestro20 and 100 Lite modem initialization:

LED indicator light	Modem mode/ instructions
LED is not on:	The modem is not on. Connect the modem to the network device.
LED is on:	The power is on but the modem is not ready to use. Inspect the following: 1. EH-60/EH-686 has the same PIN code as the GSM modem's SIM card PIN code. During initialization of the GSM modem the PIN code must be 0000. 2. After the modem is connected turn the power off and then on.
LED blinks slowly:	The modem is ready to use.
LED blinks rapidly:	The modem sends or receives messages. If a message does not come from the controller/controlling device, check the text message you have sent to see that the device ID and keyword have been written correctly. Also check that EH-60/EH-686 has the operator's message centre number of the GSM connection you have in use. Saunalahti connection is a default. You can find specific instructions for connecting the GSM modem to a master device from the EH-60/EH-686 user manual under GSM modem initialization.

USING THE BROWSER

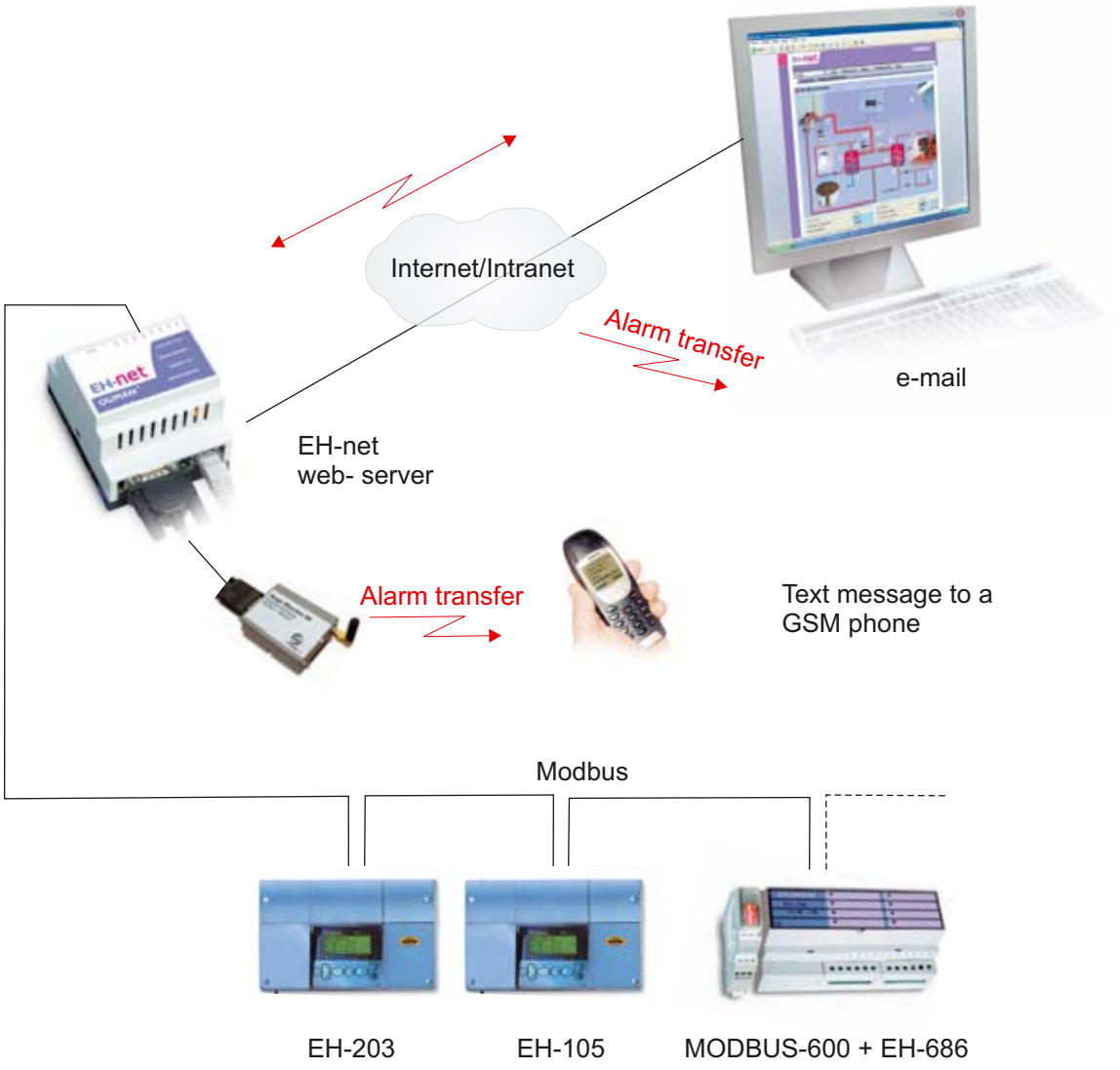
If a MODBUS bus adapter card (optional equipment) has been installed into Ouman EH-203 the controller can be connected to a browser-based user interface through the Modbus bus using the EH-net.

The EH-net can be connected to the public Internet network or to the local network, intranet. If the EH-net is connected directly to a public IP address, we recommend using a firewall device between the EH-net and the network.

By using the browser it is possible to communicate with the EH-203 controller from any pc. Information from the controller can be read and changed from the pc. If desired, entry to certain functions can be limited or certain things can be hidden that can be security risks or which are not relevant.

If the controller gives an alarm, alarm information can be transmitted by e-mail. If a GSM modem is connected to the master device, alarm information can be transmitted as text messages to a GSM phone.

Specific instructions for installing the MODBUS into the EH-203 controller and initialization come with the bus adapter card. Instructions for network connections and initialization come with the EH-net master device.



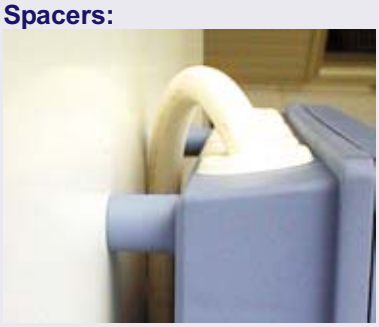
Changing the fuse:

Switch off the voltage from the regul. Press the fuse socket and turn it counterclockwise. Change the 200mA (5x20mm) glass tube fuse. Press and turn the fuse socket clockwise into place.

Changing the battery:

EH-203 has a backup that saves the time and time program in case of a short power failure. If the time is not correct after the power failure, the battery must be changed. Battery type: Lithium button battery CR 1220, 3V. Unfasten the regulator's fuse (see the topmost picture). Carefully pry the old battery from its holder, for eg., with a thin screw driver. Push the new battery into the holder with the + end up. The old battery can be put into the garbage.

Spacers:



The cables can be routed between the regulator and installation base when spacers are used to mount the regulator.

Plugs:

Complete installation by pressing the plastic plugs into the screw holes.

EH-203 is fastened to its mounting base with three screws (two mounting points under the cover in the connection space and one in the installation bracket.
Cables can be brought for the regulator from above (standard factory delivery) or from below. In addition, there are 6 cable through-holes in the bottom of the regulator case which can be opened, e.g., with a screw driver. Then the cables can be brought into the connection space through the bottom.

Cabling from above:
(standard factory delivery)

Cabling from below:
(turn the keyboard/display unit)

Mounting guide:
Screw the regulator to the wall using the installation bracket. Position the unit so it is level. Screw the regulator firmly into place using two screws through the connection space.

If you want to bring the cables to the regulator from below, you must turn the keyboard/display unit according to the following instructions.

Changing the cabling direction:

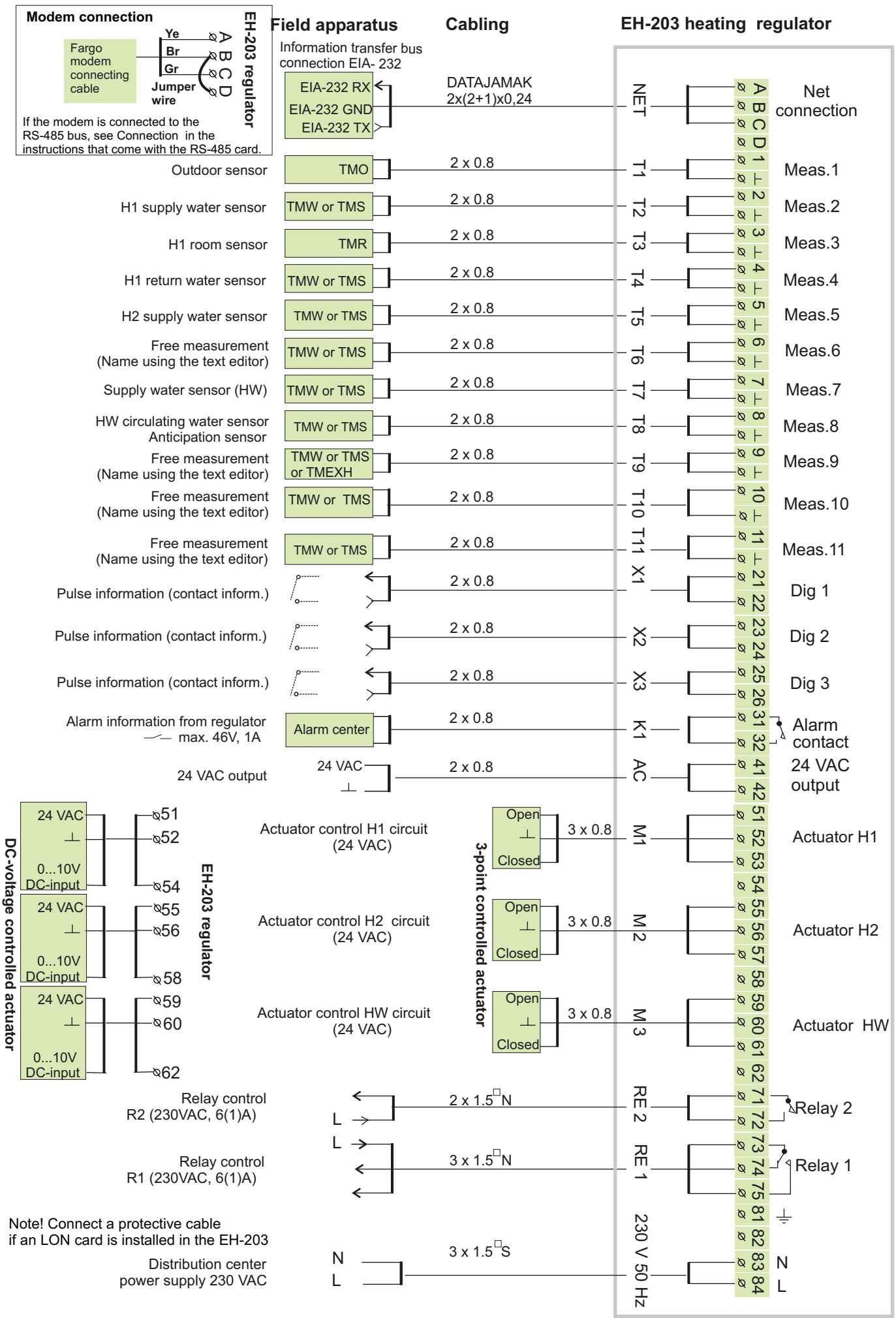
Remove the clear cover. Press as illustrated in the picture and pull the cover out of place.

Detach the keyboard/display unit carefully by prying it with a screwdriver.

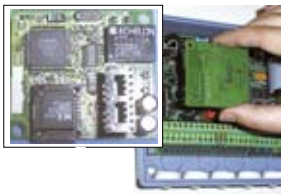
Turn the keyboard/display unit into the opposite position.

Press the keyboard/display unit carefully into place.

OUMAN EH-203 GENERAL CONNECTION DIAGRAM



OPTIONAL EQUIPMENT



LON-200

LON-200 is an adapter card which makes the EH-200 series controllers' serial communication bus compatible with the LON-200 field bus. Installation and initialization instructions come with the LON-200 adapter card.

EH-485

Ouman EH-203 has an EH-485 bus adapter card as optional equipment which makes the EH-203 controllers' serial communication bus compatible with the RS-485 field bus.

MODBUS-200

MODBUS-200 is an adapter card which makes the EH-200 series controllers' serial communication bus compatible with the RS-485 field bus. The physical interface to the field bus is galvanically isolated RS-485 network.

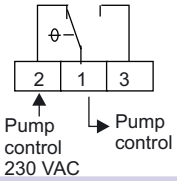
Surface mounted thermostat CO1A

AC 250V 15 (2,5) A

C01A

In floor heating solutions it is important to make sure that exessively hot water which could damage structures or surfaces doesn't ever get into the network. A mechanical thermostat should be installed on a supply water pipe which stops the circulation pump in case of overheating. Set the thermostat at 40 ... 45 °C. Set the EH-203 regulator's maximum limit between +35 ... +40 °C and the minimum limit between +20 ... +25 °C.

Model	Set point range °C	Differential range °C	Temp. of cover, °C
CO1A	+20...+90	7	-35...+120



GSM modem

A GSM modem makes if possible to communicate with EH-203 via text messages. With browser-based remote use the alarms can be transmitted as text messages to the GSM phone.

EMR-200

EH-203 has a plug connection for the energy meter read head. When a district heating energy meter is connected to the EH-203 controller using an EMR-200 energy meter read head, the district heating meter measurement information can be read from the EH-203 controller. If the controller has a GSM connection, the measurement information can be received as a text message upon request and once a month automatically to two selected GSM numbers.

EH-686

An input/output unit which contains relays, analog and digital inputs as well as analog outputs. The unit makes it possible to carry out time controlled relay functions, transfer alarms using digital inputs and make an individual regulating circuit. EH-686 can also function as a master in the OumanRS-485 bus by directing traffic in the net.

EH-net

EH-203 can be remotely used (browser-based) in the Ethernet network using an EH-net server. The EH-203 controller must have a modbus-200 adapter card to enable an EH-net connection.

PAN-200

The panel installation kit can be used to install the EH-203 controller to e.g., the control cabin. The size of the installation hole is 222 mm x 138 mm.

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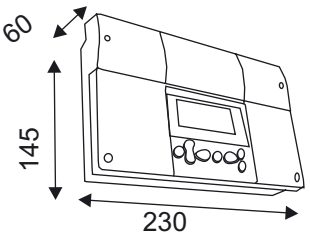
OUMAN EH-203

Technical information:

Operat. voltage:	230 VAC, 50 Hz, 0.20 A
Casing:	PC/ ABS
Protection class:	Without cover seal IP 41
Measurements (mm):	
Weight:	1.2 kg
Cabling direct.:	From above or below (turnable display and keyboard). Through holes on the bottom.
Regulator type:	Heating circuit's PID; domestic hot water circuit's PID + exchange + quick run
Measurements:	11 pieces (NTC 10 kΩ)
Clock programs:	max. 7 program phases/ regulating circuit (The regulating circuits have 14 all together) max. 7 program phases/ relay (begins-ends = 1 program phase)

Digital inputs:	3 pieces The potential free contact is connected to the digital input (load 6...9 VDC/20 mA)
Outputs:	3 actuator control outputs 3- point 24 VAC or voltage control (0...10 V or 2...10 V) Actuator's combined output power max. 25 VA
Relay outputs:	1 break before make contact relay 230VAC/ 6(1)A and 1 norm. open contact relay 230 VAC/ 6(1)A
Alarm relay outputs	1/ 24VAC/ 1A
Information transfer connection:	Standard equipment: EIA-232C Optional equipment:RS-485, MODBUS or LON:
Operating temp.:	0 … +50°C
Storing temperature:	-20 … +70 °C
Approvals:	
EMC-directive	89/336/EEC, 92/31/EEC
-Interference toler.	EN 61000-6-1
-Interf. emissions:	EN 61000-6-3
Small voltage direct.	73/23/EEC
- Safety	EN 60730-1
Warranty:	2 years
Manufacturer:	Ouman Finland Oy Kempele Finland

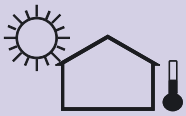
АЯ46

Regulation principles:

Supply water regulation according to the outdoor temperature.

Supply water regulation according to the outdoor temperature, including the inside temperature measure-ment. (room compensation)

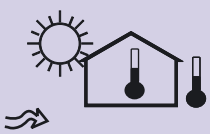
Supply water regulation according to the outdoor temperature, including wind compensation.



Supply water regulation according to the outdoor temperature, including sun compensation (net measurement).

Supply water regulation according to the outdoor temperature, including the inside temperature measurement (room compensation) and wind compensation.

Supply water regulation according to the outdoor temperature, including the inside temperature measurement (room compensation) and sun compensation.



Supply water regulation according to the outdoor temperature, including the inside temperature measurement (room compensation) and both sun (net measurement) and wind compensation.

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www.ouman.fi

We reserve the rights to make technical changes.

KILPAILIJAN TEHTÄVÄT ARVIOINTIOSA 5

VIANHAKU

Tehtävässä korjataan tietokoneella ohjattava askelmoottorin ohjainkortti. Tehtävässä etsitään seuraavia vikoja: piirikaaviossa yksi merkittävä virhe, piirikortissa kaksi ladontavirhettä, ohjelmistossa kaksi virhettä, mitoittaa oikea komponentti.

Vikojen etsintä ja korjaus aloitetaan vikaosioista **1 ja 2**. Kun ne ovat löytyneet, voi laitteen kytkeä käyttövalmiiksi (Liite 1). Sen jälkeen etsitään ja korjataan viat **3 ja 4**. Lopuksi viimeinen, vikaosio **5**. Ennen tehtävän aloittamista tutustu annettuun materiaaliin huolella.

Kun kilpailija on löytänyt vian, hän ilmoittaa sen valvovalle tuomarille. Oikein löydetystä vikaosiosta saa **neljä (4)** pistettä. Toisella yrittämällä löydetystä viasta saa **kaksi (2)** pistettä. Toisen epäonnistuneen yrityksen jälkeen kyseisestä viasta ei anneta enää pisteitä. Tuomari antaa tarvittaessa ohjeet vian korjaamiseen, jotta kilpailija voi jatkaa eteenpäin.

Kilpailijalle annetaan tehtävää varten.

- Askelmoottori
- Ohjausyksikön piirikortti
- Ohjelmointilaite AVRISP mkII
- Kaksi USB johtoa
- Kytkentälankaa
- Muistitikku
  - Ohjelmakoodit (kansio \Ohjelma)
    - T2010_5 (kansio)
  - Motor_Terminal.exe
  - Virtuaali COM-portin ajurit (CDM 2.06.00 kansio)
  - Kortilla käytettyjen komponenttien datalehtiä (\Datalehdet)

Liitteet

1 Kytkentä ja toimintakuvaus
2 Ohjauskortin osaluettelo
3 Ohjelmakoodien listaukset
4 Piirikaavio
5 Osasijoittelukuva

Osion maksimipisteet: 20 p

1. PIIRILEVYN SUUNNITTELUVIKA

Kytkentäkaavioon on jäänyt suunnitteluvaiheessa virhe, joka vaikuttaa toimintaan vakavasti. Piirikortin johdotus vastaa kytkentäkaaviota.
Etsi virhe, ja ilmoita se tuomarille. Tuomarin hyväksynnän jälkeen korjaa kytkentä.

(0 - 4p)

2. LADONTAVIAT

Piirilevylle on asennettu **kaksi (2)** virheellistä komponenttia, joista toinen on asennettu väärin ja toinen ei ole piirikaavion mukainen. Yhdestä viasta saa **kaksi** pistettä. Toisella yrityksellä **yhden** pisteen.
Etsi virheet ja ilmoita ne tuomarille. Tuomarin hyväksynnän jälkeen korjaa ladontavirheet.

(0 - 4p)

3. OHJELMAVIKA 1 – USART vastaanottaa vain yhden merkin

On testattu että pääteohjelma Motor_Terminal lähettää USB kautta oikean datan (5 tavua), mutta USART vastaanottopuskuri, Rx_Buf[], näyttää silti sisältävän ainoastaan yhden merkin.
Etsi virhe ja korjaa se ohjelmakoodiin. Ilmoita löytämäsi virhe tuomarille.

(0 - 4p)

4. OHJELMAVIKA 2 – Moottori pyörii vain yhteen suuntaan

Moottori askeltaa aina samaan suuntaan, vaikka Motor_Terminal ohjelmasta valitsee suunnaksi Eteen.
Etsi virhe ja korjaa se ohjelmakoodiin. Ilmoita löytämäsi virhe tuomarille.

(0 - 4p)

5. KOMPONENTTIVIKA – Komponentin mitoitus

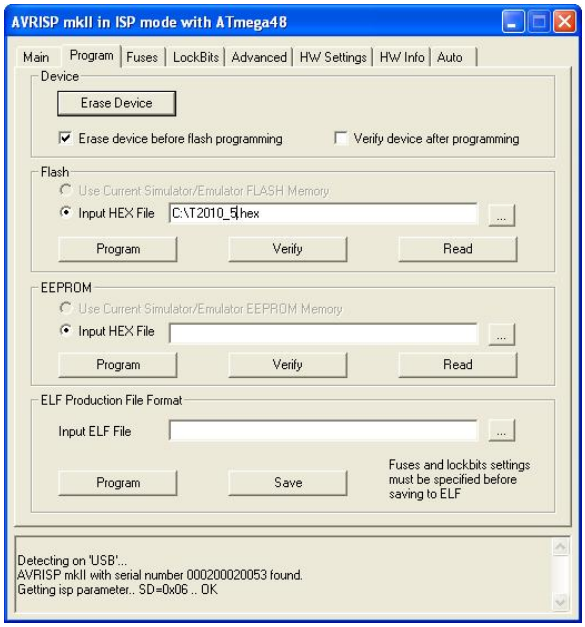
Mitoittaa yksi (1) osa uudelleen siten että NE555 piirillä toteutetun kytkennän värähtelytaajuuden alaraja on laskennallisesti 67Hz ja yläraja 1035Hz. Säädä todellinen taajuus 770Hz (+/- 10Hz).
Osiossa saa 4p oikeankokoisesta komponentista ja oikein säädetystä taajuudesta.
Ilmoita korvattava komponentti ja uuden komponentin arvo tuomarille. Säädä taajuus ja esitä mittaustulos oskilloskoopilta tuomarille.

(0 - 4p)

OHJEITA OHJELMOINTIIN

Ohjelmakoodeja voit muokata ja kääntää AVR Studio 4. Lataat käännetyn hex tiedoston kortille näin:

1 Avaa toiminto Tools / Program AVR / Connect
2 Valitse ohjelmointilaitteeksi **AVRISP mkII** ja portiksi **USB**. Klikkaa sen jälkeen **Connect**.
3 Avaa kääntämäsi hex-tiedosto kohtaan **Flash** / **Input HEX File** ja klikkaa **Program**.



ARVIOINTI

Piirilevyn suunnitteluvika	4p
Ladontaviat 2kpl	4p
Ohjelmavirhe 1 – USART vastaanottaa vain yhden merkin	4p
Ohjelmavirhe 2 – Moottori pyörii vain yhteen suuntaan	4p
Mitoitettava komponentti	4p
Maksimi	20p

LIITE 1. KYTKENTÄ JA TOIMINTAKUVAUS

Jännitteet saa kytkeä vasta kun kilpailija on korjannut foliovian ja ladontaviat. Tämän jälkeen säädä jännitelähteestä 12VDC ja kytke 12V **J2.1**, 0V **J2.2** liittimeen. Kytke askelmoottori liittimeen **J3.** Lataa ohjelma mikro-ohjaimelle.

Virtuaali COM-portin asennus
Kopioi ajurikansio, CDM 2.06.00 WHQL, koneelle jonnekkin mistä löydät sen. Kytke USB kaapeli laitteen ja PC:n välille.

XP
Ensimmäisellä kerralla PC ilmoittaa löytäneensä laitteen, tämä asennus tehdään vain kerran. Valitse Hardware wizardista Install from list or specific location, paina Next.
Valitse oikea hakemisto eli ajurien kansio, paina Next. Valitse Install from list or specific location ja paina Next niin asennus alkaa. Kun kaikki on valmista klikkaa Finish. Tämän jälkeen kone ilmoittaa uuden laitteen löytymisestä, valitse Install from list or specific location, Next. Oletuksena tulee sama hakemistopolku kuin edellisessä kohdassa, Next. Kun valmista kone ilmoittaa että on asentanut USB Serial portin, paina Finish.

PORTIN ASETUKSET
Klikkaa hiiren oikella näppäimellä Oma Tietokone, valitse Hallitse, Laitehallinta, Portit.
Klikkaa kaksi kertaa USB Serial Port.
Välilehti Port Settings ja asetusten tulee näyttää tältä,

- Bits per Second; 9600
- 8databittiä
- ei pariteettia
- 1stop bitti
- vuonohjaus; None.

Klikkaa Advanced, tee portista COM3 ja paina OK.
Nyt koneessa on virtuaalinen sarjaportti oikeilla asetuksilla.

Pääyhteistyökumppanit: Electrolux, Toyota, NRJ, ISS, Teknologia teollisuus, jalas, Oulu inspiroi, S-Ryhmä
Järjestämässä: Oulun seudun ammattiopisto, osekk, Luovi, OAKK, Oulun seudun ammattikorkeakoulu

Kun laitetta aletaan käyttää, täytyy ensin avata yhteys valitsemalla oikea portti Motor_Terminal.exe ohjelmasta ja painamalla Avaa portti painiketta (portti joka valittii yllä). Tällöin ohjelma lähettää kortille laitekyselyn ja mikäli laite on kunnossa, se vastaa. Tällöin laite on yhdistetty ja toimintakunnossa.

Askeleet- ja Nopeus-kenttiin voi kirjoittaa positiivisen 16-bit luvun. Jos Askeleet-kenttään kirjoittaa 0, ajaa moottori loputtomiin. Mikäli Nopeus-kenttään kirjoittaa 0, siirtyy kellon prioriteetti ulkoiselle kellosignaalille. Askeleen koon voi valita 1/1, 1/2, 1/4, 1/8.

Yhdistetty ja oikein täytetyt kentät näyttää esimerkiksi tältä.

Kun painetaan Lähetä-painiketta ohjelma lähettää 5 tavua, piilottaa Lähetä-painikkeen ja jää odottamaan laitteelta kuittausta datan käsittelystä. Laite käsittelee datan ja kuittaa tavulla 0x80, kun tämä merkki on vastaanotettu, Lähetä-painike on jälleen näkyvissä ja ohjelmalla voidaan lähettää uusi data.

LIITE 2. OHJAUSKORTIN OSALUETTELO

IC1	IC, ATMEGA48PV-10PU
IC2	IC, IMT-901
IC3	IC, NE555
IC4	IC, FT232RL
IC5	REGULATOR, LM1117-SO
D1	DIODE, 1N4007
D2-D5	DIODE, SR504
D6	DIODE, 1N4148
D7	LED, 3mm GREEN
D8	LED, 3mm RED
D9	LED, 3mm YELLOW
Q1	CRYSTAL, 8 MHz
R1, R2	RESISTOR, 1Ω 3W
R3	RESISTOR, 1kΩ 1/4W
R4	RESISTOR, 10kΩ 1/4W
R5, R6, R7	RESISTOR, 12kΩ 1/4W
R8	RESISTOR, 120Ω 1/4W
R9	RESISTOR, 470Ω 1/4W
R10	RESISTOR, 330Ω 1/4W
VR1	POT, 100kΩ
RN1	RESISTORNET, 8x 10kΩ
C1	CAPACITOR, 47µF
C2	CAPACITOR, 100µF
C3-C5, C9, C11-C13	CAPACITOR, 100nF
C8	CAPACITOR, 3,3nF
C6, C7	CAPACITOR, 22pF
C10	CAPACITOR, 1000µF
F1	FUSE, 2A
J1	CONNECTOR, USB/B
J2	CONNECTOR, 2pin
J3	CONNECTOR, 4pin
J4	CONNECTOR, 6pin

LIITE 3. OHJELMAKOODI LISTAUS – T2010_5.C

```
/************************************************************/
/*    Project; T2010 vianhaku osio 5                        */
/*    Versio;  2.0                                          */
/*    Tekijä; Jussi Holsti                                  */
/*    Kilpailijan nimi; (laita nimesi tähän)                */
/************************************************************/

#include <avr/io.h>
#include <avr/interrupt.h>

#define XTAL 8000000        // kellotaajuus
#define BAUD 9600           // sarjaportin nopeus

// dataväylän määritykset
#define REF_IN          0x01
#define M2              0x02
#define M1              0x04
#define CK              0x08
#define DISABLE         0x20
#define CW_CCW          0x40
#define DATA_PORT       PORTC
#define DATA_DDR        DDRC

// funktioiden prototyypit
void Main_Init(void);
void Timer1_Init(void);
void USART_Init(void);
void USART_Transmit(char data);
void Process_Data(void);

// Globaalit muuttujat
uint8_t  Index=0
        ,Data_Ready=0;
uint16_t Speed=0
        ,Count_CK=0
        ,Steps=0
        ,Step_Count=0;
uint8_t Rx_Buf[5];      // vastaanottopuskuri


/*****************************
*    Pääohjelma alkaa        *
*****************************/

int main(void)
{
    Main_Init();                // alustetaan

    while(1)                    // pääsilmukka
    {
        if(Data_Ready)          // vastaanotettu koko merkkijono
            Process_Data();     // käsitellän data
    }
}
```


Pääyhteistyökumppanit: Electrolux, Toyota, Energy, ISS, Teknologia teollisuus, jalas, Oulu inspiroi, S-Ryhmä
Järjestämässä: Oulun seudun ammattiopisto, osekk, Luovi, OAKK, Oulun seudun ammattikorkeakoulu

```
/**************************************
*     Keskeytysrutiini CK signaalille          *
**************************************/

ISR(TIMER1_OVF_vect)
{
      static uint16_t i;
      TCNT1H = 0xFF;
      TCNT1L = 0xEA;  //noin 47kHz

      // lasketaan riittävä määrä keskeytyksiä CK muutokseen ja kunnes askelia on riittävästi
      // tai askeleet 0 eli ajetaan aina
      if((i++ >= Count_CK) && ((Step_Count < Steps) || !Steps))
      {
            i = 1;                        // alustetaan
            Step_Count++;                 // askel laskuri
            DATA_PORT ^= CK;              // vaihdetaan CK tila
      }
}



/**************************
*     Vastaanottokeskeytys     *
**************************/

ISR(USART_RX_vect)
{
      uint8_t data=0;                     // paikalliset muutujat
      data = UDR0;                        // luetaan rekisteri

      if(data == 0x3F)                    // "?", laitekysely
            USART_Transmit(0x21);         // "!", vastataan että ollaan "langan" päässä
      else
      {
            Rx_Buf[Index] = data;         // merkki bufferiin
            if(Index >= 5)                // saatu 5 tavua eli koko data
            {
                  Data_Ready=1;           // lippu ylös
                  Index=0;                // nollataan indeksi
            }
      }
}



/**************************
*     Lähetysfunktio               *
**************************/

void USART_Transmit(char data)
{
      while (!( UCSR0A & (1<<UDRE0)));  // odota kunnes lähtöpuskuri tyhjä
      UDR0 = data;                      // lähtevä merkki datarekisteriin
}
```

```
/*******************************
*     Käsitellään tullut data          *
*******************************/

void Process_Data(void)
{
    uint8_t Sets=0, MASK=DISABLE;

    // 0.tavu asetukset,
    // 1.tavu nopeuden L bitit,
    // 2.tavu nopeuden H bitit
    // 3.tavu askeleiden L bitit
    // 4.tavu askeleiden H bitit

    Sets = Rx_Buf[0];                       // käsitellään ensimmäinen tavu

    if(Sets & 0x40)     MASK |= M1 | M2;    // 1/8 askel
    if(Sets & 0x20)     MASK |= M2;         // 1/4 askel
    if(Sets & 0x10)     MASK |= M1;         // 1/2 askel
    if(Sets & 0x08)     ;                   // 1/1 askel
    if(Sets & 0x04)     MASK &= ~DISABLE; // ~on/ off
    if(Sets & 0x02)     MASK |= CW_CCW;     // eteen
    if(Sets & 0x01)     MASK |= REF_IN;     // 100% tehosta

    DATA_PORT = MASK;           // asetukset porttiin

    Speed  = Rx_Buf[1];         // 0000|0000|xxxx|xxxx
    Speed |= Rx_Buf[2] << 8;    // xxxx|xxxx|0000|0000
    Count_CK = 20000/Speed;     // määritetään montako kierrosta lasketaan keskeytyksessä

    if(!Speed)                  // 0-nopeudella annetaan prioriteetti ulkoiselle oskillaattorille
    {
        TIMSK1 &= ~(1<<TOIE1);      // kielletään ylivuotokeskeytys
        DATA_PORT &= ~CK;           // CK ylösveto pois
        DATA_DDR &= ~CK;            // suurimpedanssitilaan
    }

    else
    {
        TIMSK1 |= 1<<TOIE1;         // sallitaan ylivuotokeskeytys
        DATA_DDR |= CK;             // muuten CK lähdöksi
    }

    Step_Count=0;

    Steps = Rx_Buf[3];          // 0000|0000|xxxx|xxxx
    Steps |= Rx_Buf[4] << 8;    // xxxx|xxxx|0000|0000
    Steps *= 2;                 // lasketaan puoliaallon tarkkuudella
                                // 2x puoli == kokoaalto
    USART_Transmit(0x80);       // kuitataan tietokoneelle data käsitellyksi
    Data_Ready=0;               //merkkijono käsitelty, valmis uuteen dataan
}
```

```
/*******************************
*     Pääohjelman alustukset          *
*******************************/

void Main_Init(void)
{
      Timer1_Init();              // Timer 1
      USART_Init();               // Sarjaliikenne
      sei();                      // Globaali keskeytysbitti

      DATA_DDR = 0x3F;    // dataväylän alustus
      DATA_PORT = 0x20;
}



/**********************
*     Timer1 alustus        *
**********************/

void Timer1_Init(void)
{
      TCCR1B |= 1<<CS11;          // clk/8 = 1MHz
      TIMSK1 |= 1<<TOIE1;         // T/C1 overflow interrupt enable
      TCNT1H = 0xFF;              // noin 47kHz
      TCNT1L = 0xEA;
}



/**************************
*     Sarjaliikenne alustus       *
**************************/

void USART_Init(void)
{
      UBRR0H = 0x00;                        // ylempi jää tyhjäksi
      UBRR0L = ((XTAL/16)/BAUD)-1;      // lasketaan siirtonopeus
      UCSR0B |= (1<<RXCIE0) | (1<<RXEN0) | (1<<TXEN0);
      // Bit3; Tx Enable, Bit4; Rx Enable, Bit7; Rx interrupt enable
      UCSR0C = (1<<UCSZ01) | (1<<UCSZ00);     //1-0.Tavun koko, 8-bit
}
```

Tarkistusohjeet tuomareille

1 - Piirikaavion suunnitteluvirhe

Johdin puuttuu väliltä ATMEGA48 8jalka ja GND. Hyväksyttävä suoritus on siisti ja läheltä jompattu.

2 – Ladontaviat 1,2

Elko C1 47µF on asennettu väärinpäin, kerko C8 10nF tulee korvata 3,3nF kerkolla.

3 – Ohjelmavika 1 - USART vastaanottaa vain yhden merkin

USART vastaanottokeskeytys funktiossa oleva vika

```
else
{
      Rx_Buf[Index] = data;          // merkki bufferiin
      // puutuva rivi,   Index++;
      if(Index >= 5)                 // saatu 5 tavua eli koko data
      {
            Data_Ready=1;            // lippu ylös
            Index=0;                 // nollataan indeksi
      }
}
```

Index++; rivin lisäys on ainoa oikea ratkaisu.

4 – Ohjelmavika 2 - moottori ei pyöri taaksepäin

Vika pääohjelman määrityksissä.

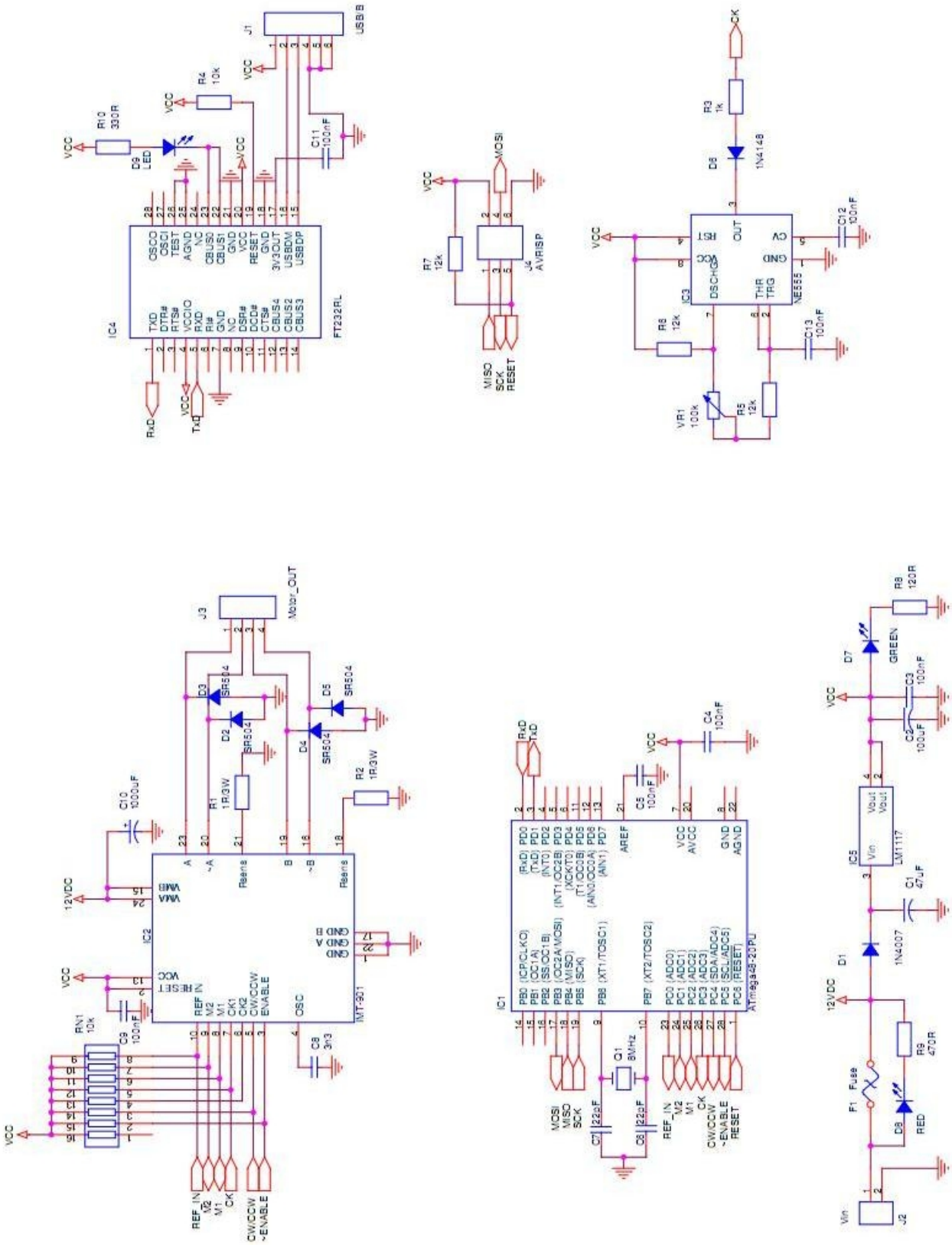
```
// dataväylän määritykset
#define REF_IN          0x01
#define M2              0x02
#define M1              0x04
#define CK              0x08
#define DISABLE         0x20
#define CW_CCW          0x40          // oikea osoite on 0x10
#define DATA_PORT       PORTC
#define DATA_DDR        DDRC
```

Suuntasignaali määritetty väärään porttiin.

5 - Mitoitettava komponentti

Oikea ratkaisu on NE555 kytkennästä R5 12k vastuksen vaihtaminen 1k vastukseen. Vastuksen vaihtamisen jälkeen tulee tuomarin tarkastaa vielä että taajuus on säädetty oikein 770Hz, +/- 10Hz.

LIITE 4. Piirikaavio



LIITE 5. OSASIJOITTELUKUVA